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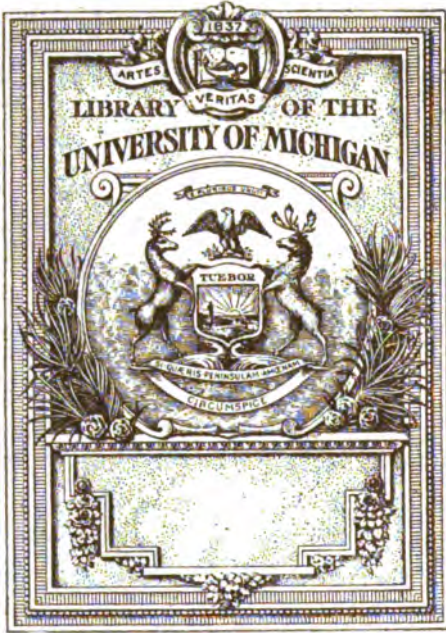
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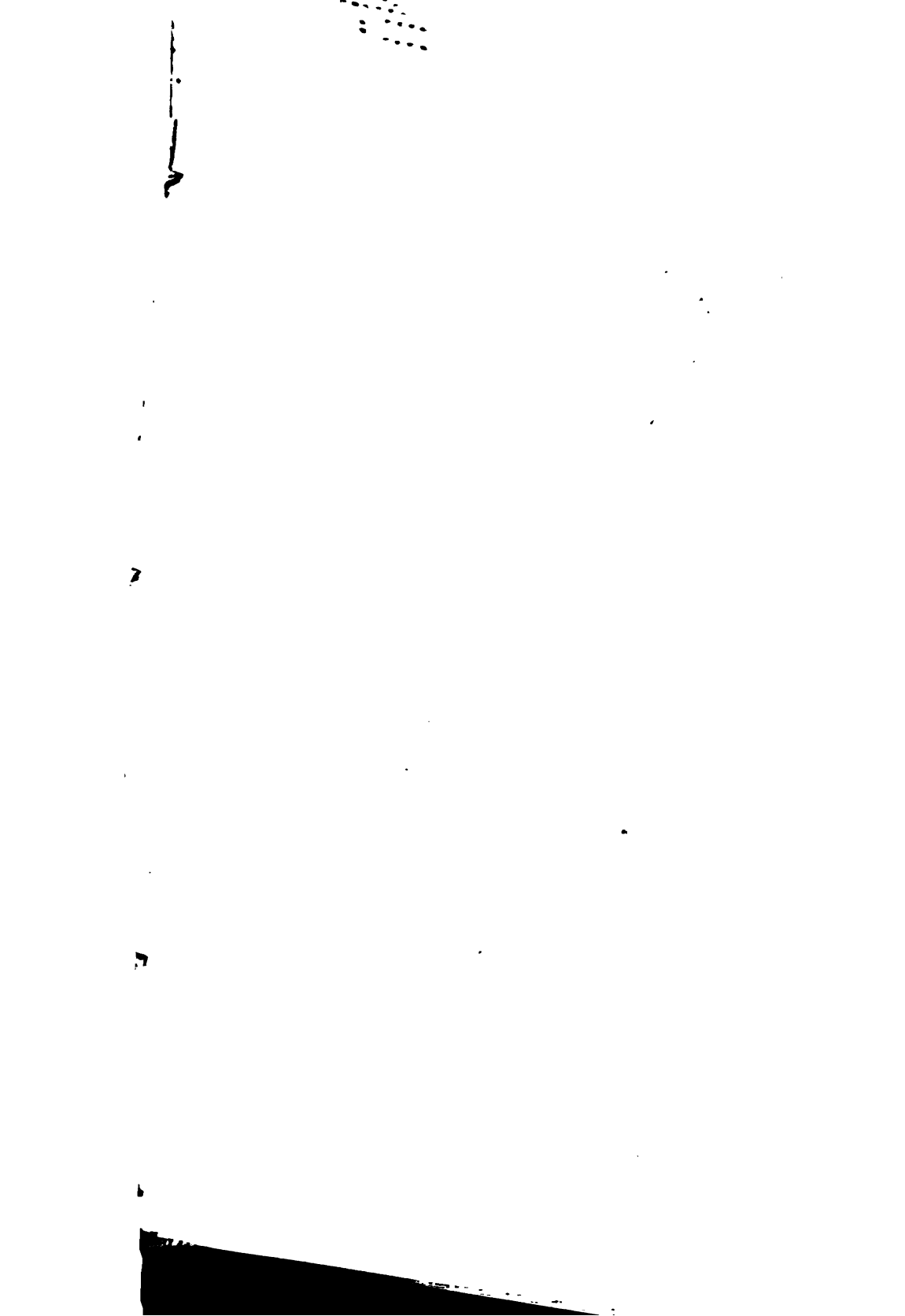






PLATE I.—Topography of the Pottsville Series and View of Cheat River, Looking South from Canyon Club House, near Mont Chateau, Monongalia County.



**WHEELING NEWS LITHO. CO.**  
**WHEELING, W. VA.**  
**1913**



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## LETTER OF TRANSMITTAL.

*To His Excellency, Hon. Henry D. Hatfield, Governor of West Virginia, and President of the West Virginia Geological Survey Commission:*

Sir: I have the honor to transmit herewith the Detailed Report and maps covering the counties of Monongalia, Marion and Taylor, prepared by Assistants Ray V. Hennen and D. B. Reger. This is one of the largest and most complete of any of the County Reports hitherto published, and needs only inspection to convey to the reader the vast amount of careful and painstaking labor expended upon the collection and assembling into orderly sequence the immense fund of information concerning the natural resources of the three counties in question.

That the authors have presented a most valuable treatise in the descriptions and maps of the area goes without saying in view of their previous work and publications. The district described is probably one of the richest in natural resources of any similar area in the entire Appalachian basin. This is true with reference to most any one of its numerous riches. In coal it occupies the heart of the Appalachian field, where the great Pittsburgh seam and the entire Monongahela series attain their greatest development, while in oil and gas production no corresponding areas are richer or contain a larger number of productive sands. Building stones, glass sands, brick and pottery clays abound, while the soils are of almost unbounded fertility wherever the measures above the Pittsburgh coal cover the surface with their self-fertilizing limestones and marly shales, so that not only the grasses, but all of the grains and fruits of the north-temperate zone find here a salubrious habitat for their best development. No finer cattle, sheep, hogs, horses, or poultry can be found than those born and bred within this area. In addition to the enormous supplies of coal, oil, and gas, nature has been especially prodigal of her gifts to this area in the vast hydro-electric power available on the two

great and rapid rivers which traverse portions of the area, viz., the Cheat and Tygarts Valley, which with the Monongahela will be able to furnish great quantities of light, heat, and power for untold ages after the vast supplies of the carbon fuels along their banks and tributaries have been exhausted.

The very complete structural maps of the three counties will prove of much aid in the development of the coal, oil, and gas resources. The soil maps and report of the U. S. Department of Agriculture, prepared by Messrs. Charles N. Mooney and W. J. Latimer of the Bureau of Soils, will prove of immense worth to agriculture, while the long lists of coal analyses by Messrs. Hite and Krak will be of great service to all interested in either the production or consumption of fuel.

I. C. WHITE.

Morgantown, W. Va., September 1st, 1913.

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## AUTHOR'S PREFACE.

As with other County Reports prepared by the writer and assistants, the most prominent geological features have been emphasized and an attempt has been made to so state the facts that they may be easily understood both by the residents of the area and State and the scientific world without conflicting with truth.

The report gives (1) a brief history of the counties and their development; (2) a study of their drainage systems and other surface features; (3) the geologic structure with a contour map of the Pittsburgh coal horizon; (4) eight chapters on their general geology and detailed stratigraphy with a map (see Map II) showing the outcrop of the different divisions of the rock column according to the generally accepted classification of American geologists; (5) a description of the oil and gas fields therein with suggestions for their future development, the same map referred to above showing the accurate location of the oil and gas wells and dry holes; (6) their minable coals, with a table showing the chemical composition, calorific value and fuel ratio and a final summary exhibiting the approximate available tonnage of coal in the three counties; (7) their clays, road materials, building stones, forests, and water-power; (8) a chapter on the soil and its products with suggestions for increasing the soil fertility; and (9) an appendix showing railroad levels therein.

As in other reports, special attention is called to the structure contours on Map II, whereon are shown the tidal elevation of the Pittsburg coal horizon at all points of the area. These contour lines, separated by 25 feet in elevation, except on the steep slope of the Chestnut Ridge anticline, where the contour interval is 100 feet, exhibit the approximate position of the horizon of this coal, the shape and location of the anticlines and synclines, and the direction of the *dip* and *strike* of the rock strata at any point, all of which is of great aid not only for the further development of the oil and gas pools therein, but also for the future mining of the several coal seams where the same are of workable dimensions, purity and regularity. Special attention is also called to the several areas outlined by the writer as "Prospective Oil and Gas Territory" by magisterial districts and page references in the Index under that heading.

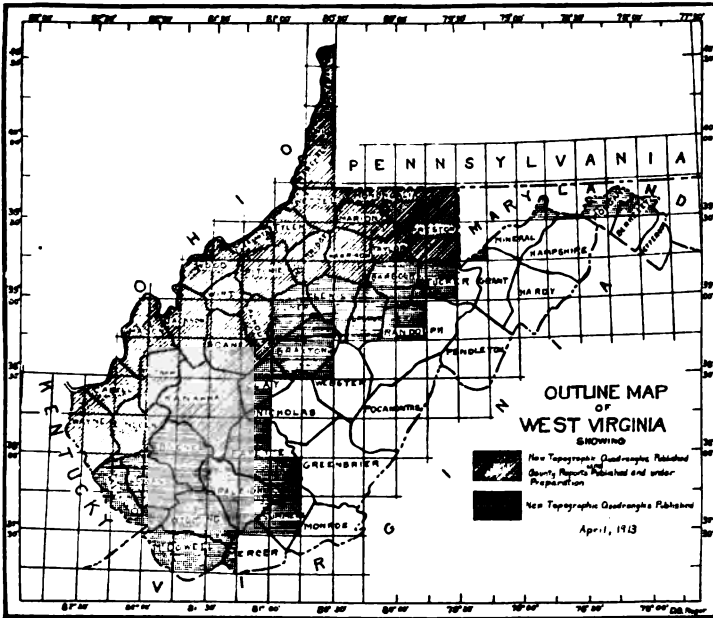


Figure 1.—Map showing County Reports published and under preparation; also Topographic Quadrangle of 1-62500 Scale.

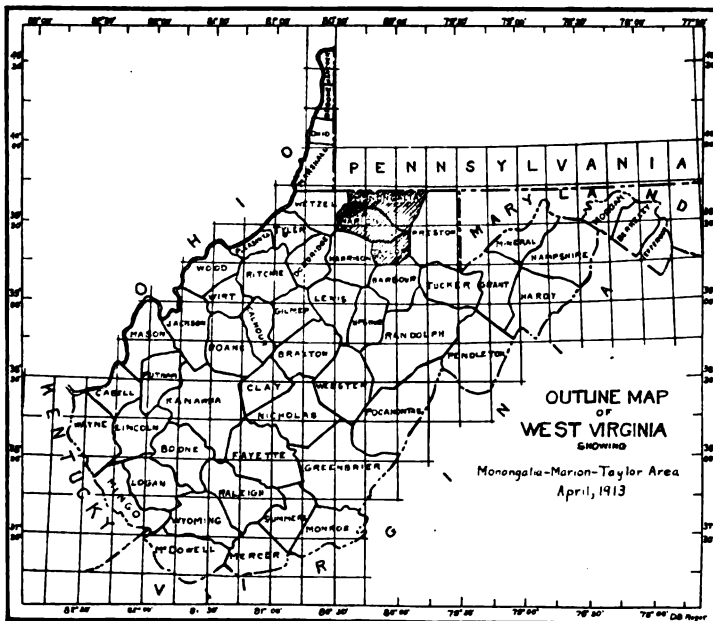


Figure 2.—Map showing location of the Monongalia-Marion-Taylor Area.

Although quite technical, the chapters dealing with the general geology and detailed stratigraphy give a large fund of data concerning the formations of the Carboniferous group of rocks by series extending from the Dunkard down through the rock column to the base of the Pocono immediately overlying the Devonian System. Therein many errors of correlation in former State Reports are corrected, the writer ever keeping in mind the general and accepted classification of rock strata which permits comparison with the formations in other portions of West Virginia and in other States. Attention is called to the discussion and identifications of the Fossil Fauna of the Ames, Pine Creek and Brush Creek limestones by Dr. J. W. Beede of the University of Indiana.

The chapter on Coal gives the thickness, character and general distribution of the several minable beds, along with an approximate estimate of the available area and tonnage of eight different veins, with a final summary of the total available coal for the area. The commercial mines are referred to in the table of analyses by serial numbers, the same corresponding to numbers assigned to the sample designating the accurate location of the mine on Map II.

Chapter XIII gives a description of the clays, road materials, sands, building stones, iron ore, water power resources and forests. Special attention is called to the interesting paper on the water power resources by A. H. Horton, District Engineer, Water Resources Branch of the U. S. Geological Survey.

Charles N. Mooney and W. J. Latimer of the Bureau of Soils of the Department of Agriculture, Washington, D. C., prepared the final chapter on the soil and its products, which cannot fail to interest progressive farmers in the area.

Three maps of the entire area accompany this report in a separate cover, of which Map I shows by appropriate symbols the character of the surface, the roads, streams, railroads, etc.; Map II, by the same means, the general and economic geology with several items of special economic interest; and Map III in a similar way, the character, classification and distribution of the soils. In the body of this report these maps are frequently referred to by their Roman numerals, as Map I, Map II, or Map III.

The writer and his assistant, David B. Reger, spent the field season of 1911 and two or three short trips in 1912 gathering data for this volume. Mr. Reger also assisted both in the preparation of the manuscript of the report and the accompanying maps. He is the author of nearly all of Chapter VIII, all of Chapters IX and X, the major portion of Chapter XII, and all of Chapter XIII except the section on Water Power Resources. In order that uniformity of style might be preserved throughout the book he has referred to his own work by name, as was done by the writer in other chapters.

Much valuable aid and assistance were given by residents of the area and by officials of the several companies engaged in the development of the coal, oil, gas, clays and water power resources. Due credit and acknowledgment have been given in the text for all such data published, except in the case of C. McC. Lemley, Resident Engineer of the B. & O. Railroad, who furnished some valuable photographs.

The chemical analyses and heat determinations were made in the Survey laboratory by J. Berghuis-Krak, Assistant Chemist, under the supervision of B. H. Hite, Chief Chemist.

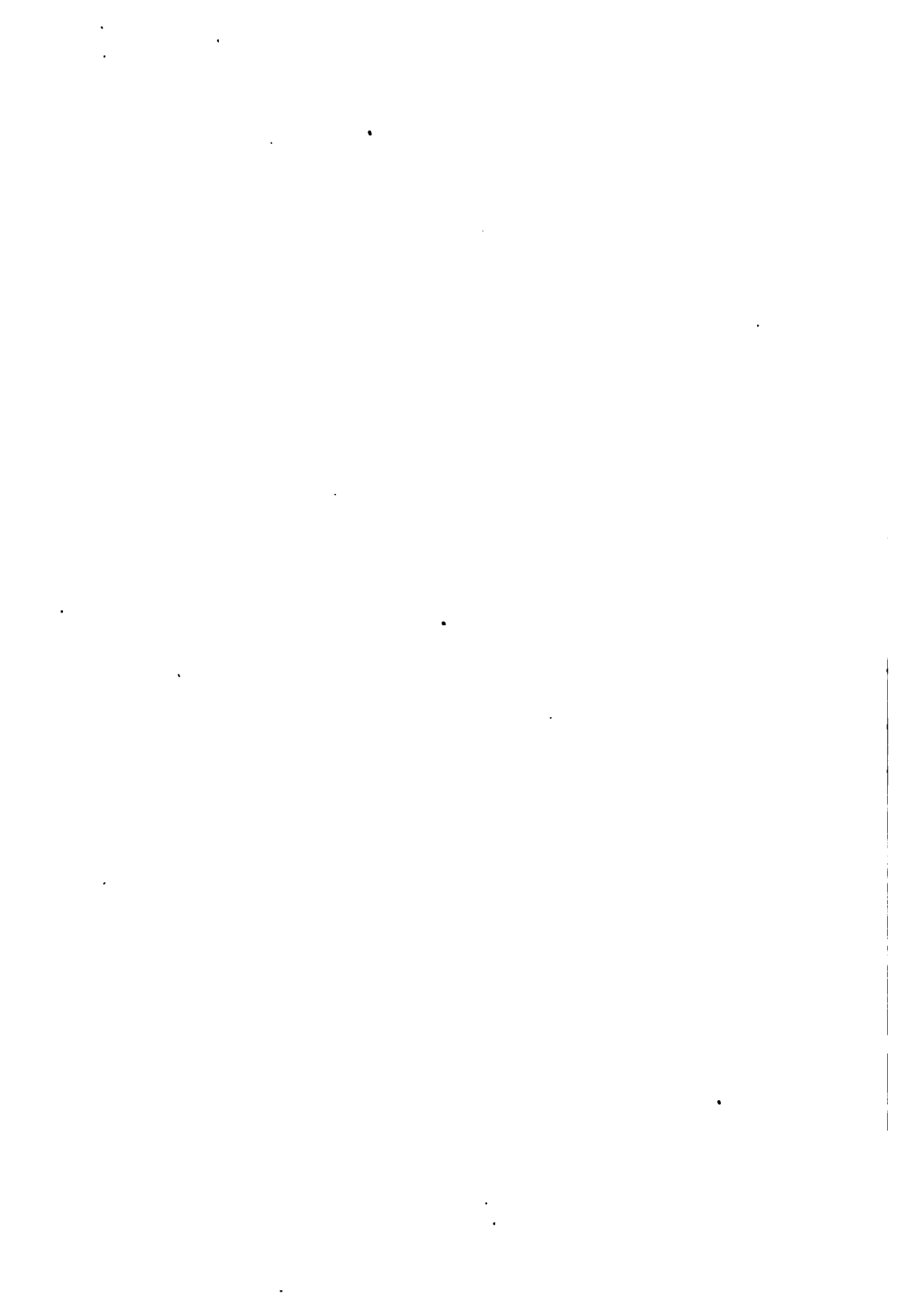
As in former reports, the writer takes opportunity to express his obligations to I. C. White, State Geologist, whose writings and suggestions have added greatly to the value of the report.

RAY V. HENNEN.

Morgantown, W. Va., April 1, 1913.

#### ERRATA.

- Page 76, "Part III" should read "Part II."
- Page 402, Well No. 130 for "James L. Park" read, "Jos. L. Parks."
- Page 448, for "John & W. L. Parks," read "Jos. & W. L. Parks."
- Page 448, elevation of Well No. 127, instead of 1000' B should be 1080' B.
- Page 449, elevation of Well No. 130 instead of 1080' B should be 1000' B.
- Page 96, for "Grant Stephens," read "Grant Stevens."
- Page 500, for "James Saunders," read James Sanders."
- Page 410, for "D. M. Heard," read "D. M. Hoard."
- Page 616, for "R. B. Coll," read "R. B. Gall."
- Page 110, at top of section read 575' instead of 1189' for thickness of Upper Carboniferous.
- Page 633, for "Prunytown," read "Pruntytown."
- Page 670, for "Mandedick Helrs," read "Mankedick Helrs."
- Page 712, beginning sentence on 22nd line read, "With this information and with a planimeter determination of the area by Reger, the following estimate is made."



# PART I.

## History and Physiography.

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### CHAPTER I.

#### THE HISTORICAL AND INDUSTRIAL DEVELOPMENT.

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##### LOCATION.

That part of West Virginia described in this report includes the area lying along and adjoining the southern boundary of Pennsylvania, near the southwest corner of the latter State, comprising the counties of Monongalia, Marion and Taylor, the whole lying between the parallels of  $39^{\circ} 14'$  and  $39^{\circ} 44'$  North latitude, and the meridians  $79^{\circ} 45'$  and  $80^{\circ} 30'$  West longitude from Greenwich. The three counties include an area of 859.5 square miles as follows: Monongalia, 368.8; Marion, 313.5; and Taylor, 177.2 square miles.

##### TRANSPORTATION.

###### Water Ways.

**Monongahela River.**—In the early days the Monongahela river and its tributary, Cheat river, were used to transport timber in log form to the accessible mills along their banks. The importance of the former stream as a means of transporting the coal from the great fields along its banks was early appreciated by the U. S. Government which has built a series of locks and dams—15 in number—along the same, making it navigable for large steamboats and barges from

Fairmont, W. Va., to Pittsburgh, Pa., a distance of 125 miles. Locks Nos. 9-15 inclusive are located in Monongalia and Marion counties, and the accurate location of each, along with its serial number, is given on Maps I, II and III. H. C. Newcomer, Lieut. Col., Corps of Engineers of the U. S. Engineer Office, Pittsburgh, Pa., has kindly furnished the Survey the data exhibited in the table on the next page. In addition to other items this table gives the distance in miles of each lock from the mouth of the river; the year of completion; the size of each lock; the tidal elevation of each pool; and the length of each dam accompanying the lock, and the material of which the dam was constructed.

For many years, Morgantown was the head of navigation on the Monongahela, but the completion of locks Nos. 10-15 inclusive in 1904, gives Fairmont that distinction.

## Elements Locks and Dams Monongahela River.

| No. | Distance from Mouth, Miles. | When Built.      | LOCK.            |                 |                               |                    | DAM.       |                  |           | ABUTMENT.                      |                  |            |                      |
|-----|-----------------------------|------------------|------------------|-----------------|-------------------------------|--------------------|------------|------------------|-----------|--------------------------------|------------------|------------|----------------------|
|     |                             |                  | Size.            | Lift Low Water. | Elevation Sills.              |                    | Founded on | Length.          | Material. | Founded on                     | Type.            | Founded on |                      |
|     |                             |                  |                  |                 | Upper.                        | Lower.             |            |                  |           |                                |                  |            |                      |
| 1   | 1.95                        | 1909             | 56x360<br>56x362 | 4.4             | 698.6 G<br>698.4 M            | 693.0 G            | 707.4      | Rock.            | 962       | Concrete on stone filled crib. | Rock and gravel. | Crib.      | Gravel.              |
| 2   | 11.2                        | 1904-6           | 56x362.5         | 7.85            | 707.1 G<br>706.6 M            | 699.25G<br>698.75M | 715.25     | Piles in gravel. | 808.2     | Concrete.                      | Piles in gravel. | Concrete   | Piles in vert. face. |
| 3   | 23.8                        | 1905-7           | 56x360           | 8.66            | 714.75G<br>56x360             | 706.75G            | 723.9      | Rock.            | 685.3     | Concrete.                      | Piles in gravel. | Concrete   | Piles in vert. face. |
| 4   | 41.24                       | 1840-4<br>1885-6 | 50x158<br>56x227 | 11.1            | *726.18<br>x723.74G           | 718.03             | 735.0      | Gravel.          | 703       | Timber stone filled.           | Gravel.          | Concrete   | Gravel.              |
| 5   | 56.73                       | 1908-10          | 56x360           | 12.1            | 738.6 G<br>56x360             | 726.6 G            | 747.1      | Rock.            | 555.3     | Concrete.                      | Piles in gravel. | Concrete   | Rock.                |
| 6   | 68.67                       | 1854-6           | 50x165           | 13.05           | 738.1 M<br>753.57G            | 741.36G            | 760.15     | Rock.            | 626       | Timber stone filled.           | Rock and gravel. | Concrete   | Gravel.              |
| 7   | 82.74                       | 1882-3           | 50x159           | 9.2             | 763.99G<br>763.84M            | 754.19G            | 769.99     | Rock.            | 520       | Timber stone filled.           | Rock and gravel. | Masonry    | Hard pan.            |
| 8   | 87.55                       | 1882-9           | 50x161           | 10.6            | 775.0 G                       | 765.0 G            | 780.8      | Rock.            | 587.5     | Timber stone filled.           | Rock and gravel. | Masonry    | Rock.                |
| 9   | 93.3                        | 1874-9           | 50x160           | 12.35           | 787.0 G                       | 775.55G            | 793.4      | Rock.            | 388.7     | Masonry.                       | Rock.            | Masonry    | Rock.                |
| 10  | 102.6                       | 1898-03          | 56x182           | 10.66           | 797.66G<br>796.66M            | 787.0 G            | 804.66     | Rock.            | 444.3     | Concrete.                      | Rock.            | Concrete   | Rock.                |
| 11  | 104.95                      | 1898-03          | 56x182           | 10.67           | 808.33G<br>807.33M            | 797.67G            | 815.33     | Rock.            | 500       | Concrete.                      | Rock.            | Concrete   | Rock.                |
| 12  | 109.85                      | 1901-4           | 56x182           | 10.67           | 819.0 G                       | 808.33G            | 826.0      | Rock.            | 425       | Concrete.                      | Rock.            | Timber     | Rock.                |
| 13  | 111.8                       | 1901-4           | 56x182           | 10.67           | 818.0 M                       | 819.0 G            | 836.67     | Rock.            | 410       | Concrete.                      | Rock.            | Concrete   | Rock.                |
| 14  | 115.5                       | 1902-4           | 56x182           | 10.67           | 829.67G<br>840.33G<br>839.33M | 829.67G            | 847.33     | Rock.            | 446       | Concrete.                      | Rock.            | Concrete   | Rock.                |
| 15  | 124.1                       | 1901-4           | 56x182           | 10.67           | 851.0 G<br>850.0 M            | 840.33G            | 858.0      | Rock.            | 430       | Concrete.                      | Rock.            | Masonry    | Rock.                |

\* = Large Lock. x = Small Lock. G = Guard Sill. M = Miter Sill.



### Steam Railroads.

**Baltimore & Ohio Railroad—Main Line.**—The main line of the Baltimore & Ohio R. R. extends entirely across Marion and Taylor counties in a northwest-southeast direction, a distance of 60 miles. This road was completed from Cumberland to Wheeling in 1852, and it is one of the main outlets for the immense coal tonnage of the three counties.

**Baltimore & Ohio Railroad—Southwest.**—This branch of the Baltimore & Ohio extends from Grafton westward, via Parkersburg, to St. Louis, Mo. It was completed from Grafton to Parkersburg in 1857, but only 13.8 miles is included in the area under discussion. This railway has a large freight traffic due to the development of the coal, oil and gas fields contiguous thereto.

**Grafton & Belington Branch—Balt. & Ohio R. R.**—This branch of the Baltimore & Ohio R. R. extends southeastward from Grafton along the east bank of Tygart river to Belington, a distance of 41.3 miles. From Grafton to the mouth of Sandy creek, where it leaves Taylor county, it is only 8.8 miles. This road was chartered in April, 1881, as the Grafton and Greenbrier Railroad, and was opened for use as a narrow gauge line between Grafton and Philippi in January, 1884. It was purchased by the Baltimore & Ohio in 1892 at foreclosure and was reorganized as the Grafton & Belington Railroad, being extended to Belington and converted to standard gauge May 1, 1892, according to C. W. Woolford, Secretary, Baltimore & Ohio R. R. Co. It has a large freight traffic in coal and lumber.

**Monongahela River Branch—B. & O. R. R.**—This branch of the Baltimore & Ohio System extends from Fairmont along the Monongahela and West Fork rivers to Clarksburg, a distance of 32.1 miles. Only 12.4 miles is included in the area under discussion, however. The road was built in 1890 by Hon. J. N. Camden, and sold in 1900 to its present owners. It has a very heavy freight traffic from the several coal mines along both banks of the river.

**Fairmont, Morgantown & Pittsburgh Branch—B. & O. R. R.**—This branch of the Baltimore & Ohio was completed

from Fairmont to Morgantown February 1, 1886, and later (April 1, 1894) extended to Uniontown, Pa. It has a very heavy freight traffic, especially in coal. That portion included within Marion and Monongalia counties is 36.5 miles long.

**Paw Paw Branch—B. & O. R. R.**—This branch extends from Fairmont via Rivesville to the Federal mine of the New England Gas & Coke Co. on Paw Paw creek, a distance of 8.7 miles. Although it hauls a few passengers, it is mostly a coal carrying road.

**Morgantown & Kingwood Railroad.**—This railroad extends from Morgantown southeastward via Masontown, Kingwood and Rowlesburg to M. & K. Junction, in Preston county, for a total distance of 47.9 miles, 10.5 miles of which is included in Monongalia county. The road was completed from Morgantown to Bretz in September, 1903; Bretz to Kingwood in March, 1906; and Kingwood to M. & K. Junction in July, 1907. It has a heavy freight traffic in coal, building stone, glass sand and lumber.

**Buckhannon & Northern Branch—Pittsburgh & Lake Erie R. R.**—This road extends along the west bank of the Monongahela river, from Fairmont to the W. Va.-Penna. State line where it connects with another branch of the same system to Brownsville, McKeesport and Pittsburgh. That portion of the road within the area under discussion—31 miles long—from Rivesville to the northern line of Monongalia county, built during 1911 and 1912, will open up a great coal field on the west side of the river in Marion and Monongalia counties.

### Electric Railroads.

**Monongahela Valley Traction Company—Fairmont & Clarksburg Branch.**—This branch, completed in December, 1906, runs mostly along the west bank of the West Fork river between Fairmont and Clarksburg, leaving it only at two or three points to cut off long ox-bows in the latter stream. It has a very heavy passenger traffic due to the many coal mines along this valley between the two cities.

**Fairmont & Mannington Railroad.**—This trolley line is

controlled by the Monongahela Valley Traction Company and extends northwestward across the divide from Fairmont to Buffalo creek at Barrackville; thence, westward along the south bank of the latter stream to Mannington, a total distance of 17 miles. The road was completed during 1910, and it has a growing passenger traffic incident to the gradual development westward of the coal mining industry.

**Monongahela Valley Traction Co.—Fairview Branch.—**

This branch was built during 1910, and extends from Fairmont to Fairview, Marion county, via Rivesville, a distance of about 16 miles. The road has a large passenger traffic, due to coal mines and oil and gas fields served by the same. It is a very important feeder to the Fairmont region, and furnishes an easy means for the farmers of northeastern Marion to reach the county seat.

**Morgantown & Dunkard Valley Railroad.**—This road extends from Morgantown to Cassville, a distance of about 8 miles. That portion from Morgantown to the mouth of Scott run at Randall was completed ready for operation on Sept. 10, 1910; and that from Randall up Scott run to Cassville, Nov. 30, 1911. It is the intention of the directors of this company to extend the line to Blacksville via Dolls run and Dunkard creek in the near future. At Blacksville it will connect with a line to be built from that point to Waynesburg, Greene county, Pennsylvania.

### Highways.

In the early history of the three counties the subject of public highways was of great interest since they furnished the only means of communication with Baltimore and other eastern points. Later, the steam railroad caused a marked cessation of interest in public roads, but during the last five years, the advent of the automobile has awakened a new concern and engaged the attention of the State Legislature to the importance of maintaining good highways.

In his History of Monongalia County, pages 536-537, Samuel T. Wiley gives the following interesting account of the earliest roads in this area:

"The first roads in the county were little more than mere bridle paths. All record of the early roads up to 1796 is lost, and tradition offers little to supply its loss. The first road, it is said, was up Decker's creek, from the site of Morgantown to Rock Forge, and then ran with the site of the present road, known as the old Kingwood road, past the Dripping Spring. It was cut out, perhaps, between 1772 and 1776, and ran by the site of Kingwood (Preston county). crossed Cheat river at Dunkard Bottom, and ran to the site of Westernport (Md.), and then to Winchester. It was a pack-horse road. After the Revolutionary war, it became an emigrant road to the West, and on the 10th of December, 1791, an act of Assembly was passed for opening a road from the State road to the mouth of Fishing creek (New Martinsville). This old road was a part of the proposed road which, from Morgantown, ran with the present Fairmont turnpike to the 'Red Bridge'. From where the 'Red Bridge' now stands, it turned off and ran by the site of McCurdysville; thence beyond the county to Basnettsville and on to the mouth of Fishing creek. It now became a wagon road. On Dec. 23, 1795, Wm. McCleery, Nicholas Cassey, Michael Kerns and Edward McCarty were appointed to repair that portion of it from Westernport to Morgantown, which was designated as 'a wagon road from the mouth of Savage river to Morgantown'. A lottery was authorized on Dec. 2, 1796, to raise money to repair this road from Morgantown to Winchester. The lottery scheme, however, was never carried out. The road was now called the old State road or the old Winchester road. In later years, after Kingwood was founded, that part from Morgantown to Kingwood was called the Kingwood road, and today (1883) is known as the old 'Kingwood road'."

**Brandonville & Fishing Creek Turnpike.**—This highway at present is only a dirt road, extending from the W. Va.-Md. line via Brandonville, Ice's Ferry bridge over Cheat river, and Morgantown to Fairmont. On pages 537 and 538 of the volume mentioned above, Wiley gives the following account of the early history of this road:

"The Brandonville and Fishing Creek Turnpike was agitated in 1830, and was projected in 1832, as the Maryland and Ohio Turnpike. In 1836, it received the first mentioned name. It ran from the Maryland line past Brandonville (Preston county), to Ice's Ferry; thence on the location of the present road from the ferry to Morgantown; thence on the location of the Fairmont Pike, on the west side of the river, to Fairmont, and on to the Ohio river at the mouth of Fishing creek. It was built between 1836 and 1839. In 1850 it was extensively repaired by Wm. J. Willey."

**Morgantown & Kingwood Pike.**—This highway is at present only a dirt road, extending southeastward from Morgantown along the dividing ridge between Aaron and Cobun creeks via Reedsville to Kingwood in Preston county. On pages 124 and 125, Wiley gives the following account of this road:

"The maximum limit of the capital stock of the Kingwood and West Union Turnpike Company was increased in 1851, and the extension of the road to Morgantown was also authorized. This road was constructed, and, between Morgantown and Kingwood, is familiarly known as the 'Morgantown and Kingwood Pike.' February 10th, the Board of Public Works was authorized to borrow \$2,800.00 with which to macadamize this pike between Morgantown and Cranberry, which work was done. After the extension of the road to Morgantown, its name was changed to that of the Morgantown, Kingwood, and West Union Turnpike. This is now (1883) the best road in all this section of the country."

**Morgantown & Bridgeport Turnpike.**—This road, which is only a dirt highway, extends along the east side of the Monongahela river from Morgantown to Fairmont; thence via Watson, Boothsville and Bridgeport to Clarksburg. Concerning its early history, Wiley has the following to say on page 538:

"The next projected highway was the Morgantown and Clarksburg Turnpike, located by Col. Jas. Evans, from Clarksburg on the east side of the river, past Smithtown, to Morgantown, and then using the Brandonville & Fishing Creek Turnpike to Ice's Ferry; thence to the Pennsylvania State line. Nothing was done beyond the location. In 1849, the Morgantown and Bridgeport Turnpike was authorized by the General Assembly, and it was built in Monongalia on the location of the Morgantown and Clarksburg road from Smithtown, by Morgantown, to the Pennsylvania State line beyond Ice's Ferry, using a part of the road from Morgantown to Ice's Ferry."

That portion from Fairmont via Boothsville to Clarksburg is now familiarly known as the Fairmont and Bridgeport turnpike; and that, northward from the old Ice's Ferry to the W. Va.-Pa. State line, as the Uniontown pike.

**Pennsylvania, Beverly & Morgantown Turnpike.**—This road, which is also only a dirt highway, extends southeastward from Morgantown along the ridge between Cobun and Booths creeks via Ridgedale, Gladesville, Independence and Evansville to Beverly, Randolph county. Concerning its early history, Wiley gives the following on page 538:

"The Pennsylvania, Beverly and Morgantown Turnpike was incorporated in 1837; was revived in 1853; and was constructed from the State line, near Fort Martin church; crossed the Monongahela at Collin's Ferry, came by Morgantown, crossing the Morgantown and Bridgeport Pike, and ran to Evansville, Preston county, and on to Beverly. From Morgantown to Evansville this road is now (1883) generally called the Evansville Pike."

**Beverly & Fairmont Turnpike.**—This highway is also only a dirt road, extending from Fairmont southeastward via McGee and Fetterman to Grafton. According to Wiley, it was partly located in 1838 by Col. Jas. Evans, who located the road from a point three or four miles east of Fetterman northwestward via Fairmont and West Warren (Wadestown), and on towards Wheeling.

**Dunkard Creek Turnpike.**—This highway was never more than a dirt road. It extended northwestward from Morgantown up Scott run; thence down Dolls run and westward up Dunkard creek across the county. Wiley gives the following account of this road on page 539 of his History of Monongalia county:

“The Dunkard Creek Turnpike was projected in 1839, and revived in 1847. It was located by Col. Jas. Evans from Morgantown to Blacksville. A Dunkard Valley Turnpike Company was projected in 1871, to operate this road, which commences one mile west of Morgantown, and passes by Granville, Randall, Cassville, Brown’s Mills, New Brownsville, Blacksville, and on to Burton, on the Baltimore & Ohio Railroad.”

**Northwestern Virginia Turnpike.**—This highway crosses the southern portion of Taylor county in an east and west direction via Pruntytown, Grafton, Thornton, Evansville and Fellowsville. This is one of the best roads in the three counties, and also one of the oldest, since it was built between 1830 and 1836, having reached Clarksburg in the latter year. The writer has given a detailed description of this road on pages 4 and 5 of the Doddridge-Harrison report of the State Geological Survey.

**Clarksburg & Weston Turnpike.**—This is only a dirt highway, and extends southwestward from Fairmont in Marion county along the west side of West Fork river via Thoburn and Worthington.

According to Bulletins published for 1910 by Chas. P. Light, State Road Commissioner, the total mileage of all kinds of public roads for the area under discussion is as follows:

|                        | Miles.      |
|------------------------|-------------|
| Monongalia County..... | 800         |
| Marion County.....     | 766         |
| Taylor County.....     | 363         |
| <b>Total.....</b>      | <b>1929</b> |

**GENERAL DESCRIPTION.****MONONGALIA COUNTY.**

Monongalia county is bounded on the north by the Mason & Dixon State line; on the east by Preston county; on the south by Taylor and Marion; and on the west by Marion and Wetzel counties.

Its area as determined by planimeter from the accurate topographic sheets of the U. S. Geological Survey, is as follows:

| Districts.            | Sq. Miles. |
|-----------------------|------------|
| Battelle .....        | 56.40      |
| Clay .....            | 63.49      |
| Cass .....            | 34.71      |
| Grant .....           | 46.61      |
| Union .....           | 60.44      |
| Morgan .....          | 39.88      |
| Clinton .....         | 67.29      |
| Total for county..... | 368.82     |

According to Lewis<sup>1</sup>, Monongalia county began its existence in October, 1776, by an act of the General Assembly of the newly-declared Commonwealth of Virginia, dividing the District of West Augusta into three distinct counties; viz., Monongalia, Ohio and Youghiogeny, and establishing the boundaries of Monongalia as follows:

"All that part of the said district<sup>2</sup> lying to the northward of the county of Augusta to the westward of the meridian of the fountain of the Potowmack, to the southward of the county of Yohogania and to the eastward of the county of Ohio, shall be one other distinct county, and shall be called and known by the name of Monongalia."

According to Henry Haymond in his History of Harrison County, page 158, additional territory was added to Monongalia county as follows:

"In October 1780 an Act was passed to the effect "That all that part of the county of Augusta North West of the Line that divides Augusta from Green-Brier, on the top of the ridge, that divides the

1. V. A. Lewis, History of W. Va., page 506; 1889.

2. Referring to the District of West Augusta.—R. V. H.

waters of Green-Brier from those of Elk and Tygarts Valley, and with that ridge to the ridge that divides the waters of Potowmack from those of Cheat, and with the same to the line that divides Augusta and Rockingham, shall be and the same is hereby added to and made part of the county of Monongalia.'"

Thus Monongalia enjoys the distinction of being one among the first counties created under a republican form of government in America. It was intended to be named for the Monongahela river, which stream almost bisects the county as at present limited, but through a clerical error received the former appellation. Lewis adds the following about the creation of the county:

"The act creating the county further provided 'that it shall and may be lawful for the landholders of said county qualified to vote in the General Assembly to meet at the house of Jonathan Cobun, in said county, on the 8th day of December following, then and there to choose the most convenient place for holding courts for the county in the future.' In 1796 the records of Monongalia county were burned, and we have no means of ascertaining whether such an election was held. We may infer that it was, as thereafter the courts were regularly convened at the plantation of Theophilus Phillips, near where New Geneva, Fayette county, Pennsylvania, now is, the last-named county at that time being a part of Monongalia. Nor can it be stated with certainty who was the first sheriff and clerk of the county. In Monongalia, tradition names Captain John Dent as the first sheriff and Colonel John Evans as the first county clerk, while a Fayette county tradition makes Joseph Coombs the first clerk."

Monongalia as now limited occupies only a small portion—slightly over 7 per cent—of the original area called for in the act of the Virginia General Assembly creating the county in 1776, which included practically the entire drainage basin of the Monongahela river above Brownsville, Penna., covering the southeast corner of Washington county, the eastern portion of Greene and the southwest portion of Fayette, in Pennsylvania; and in West Virginia, all of the present area of Monongalia, Preston, Marion, Harrison, Taylor, Barbour, the western half of Tucker, all of Randolph except a small strip along the southeast border, all of Upshur except a small strip along the southwest edge, and the eastern two-thirds of Lewis; the whole covering an area approximating 5000 square miles.

The general surface of the county varies in elevation from 793.4 feet above tide—Pool No. 9 level of the Monongahela river at Morgantown—to 2600 feet above tide near the summit



of a high knob on Chestnut Ridge in the extreme northeast corner of the county, a range in elevation of slightly over 1800 feet.

**Population.**—In 1900 the population was 19,049, of which 18,747 were white; 299, colored; and 301, foreign born. The census of 1910 gives the total population as 24,334, a gain of 5,285, or an increase of 27.74 per cent. As appears on a subsequent page, this growth in population in the last ten years has mostly taken place in the City of Morgantown, located in Morgan district, and in Westover on the opposite side of the river, in Grant district, the five other magisterial districts having lost in population during the last decade. This marked decrease in the rural portions of the county illustrates the country-wide tendency of the younger generation to leave the farms for the seemingly more attractive life of urban regions. During the last three or four years, however, the high cost of living in cities and towns has awakened a new interest in agriculture, and started a "back-to-the-farm" movement here as well as elsewhere.

The following table shows the changes in population in Monongalia county by magisterial districts during the last 20 years, as determined by the Census Bureau at Washington, D. C.:

| Districts—Monongalia County.                 | Population.  |              |              |
|--|--------------|--------------|--------------|
|  | 1910         | 1900         | 1890         |
| Battelle .....                               | 2270         | 2760         | 2452         |
| Clay, including Blacksville town.....        | 2797         | 3149         | 2827         |
| Cass .....                                   | 1173         | 1444         | 1495         |
| Grant .....                                  | 2495         | 2152         | 2118         |
| Union .....                                  | 1553         | 1637         | 1488         |
| Morgan, including Morgantown and Star City.. | 11631        | 5356         | 2973         |
| Clinton .....                                | 2415         | 2551         | 2352         |
| <b>Totals for county.....</b>                | <b>24334</b> | <b>19049</b> | <b>15705</b> |

The principal farm products of Monongalia are corn, wheat, oats, hay, potatoes, garden vegetables, apples, dairy products, beef cattle, sheep and poultry. A full discussion of



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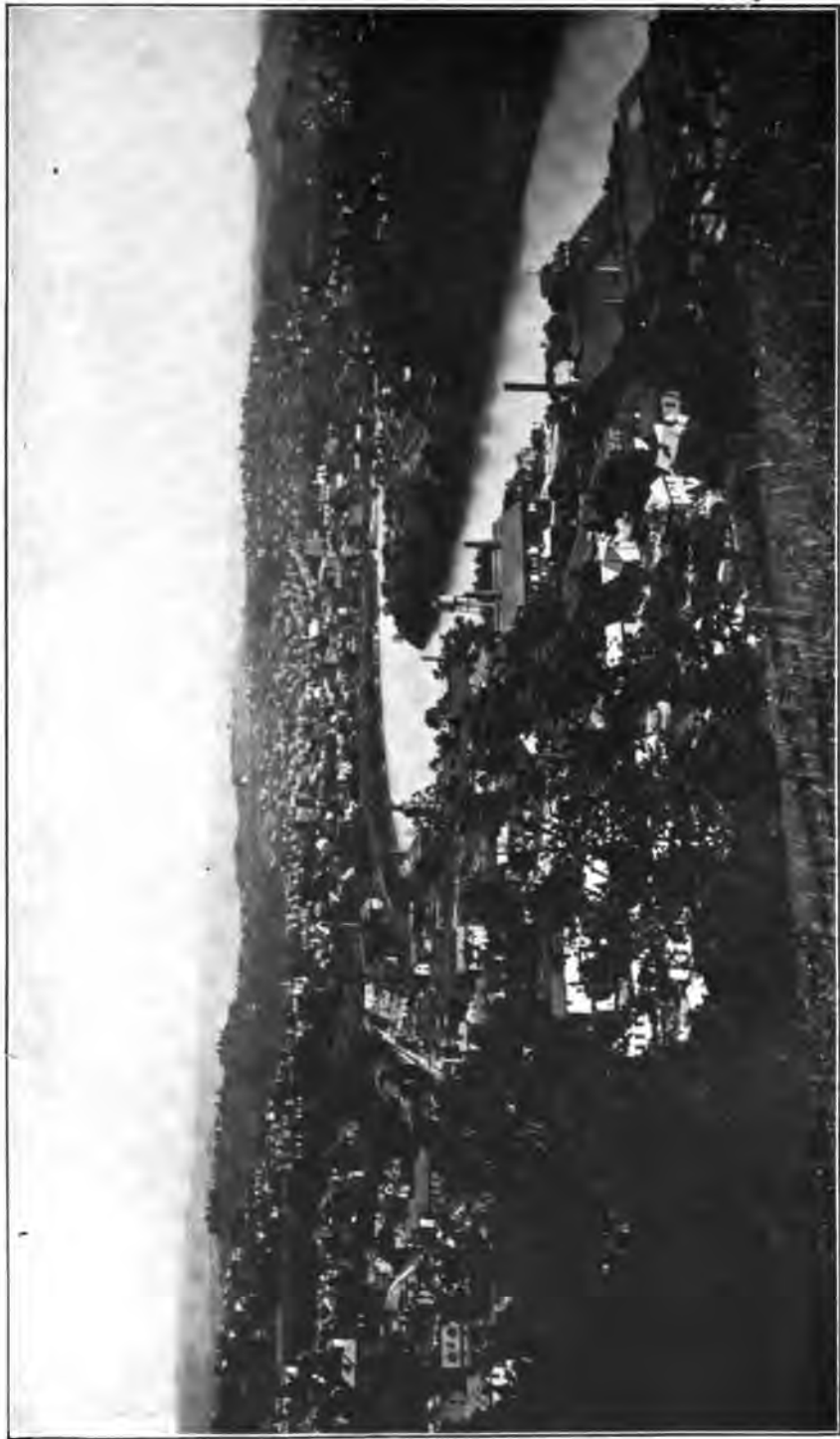


PLATE II.—View of Morgantown, Showing Topography of the Conemaugh Series, with the Allegheny and Pottsville in Chestnut Ridge on skyline.

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the character and classification of the soils therein is given in a subsequent chapter on Soils.

The principal mineral and manufactured products are coal, petroleum, natural gas, coke, building stone, glass sand, foundry products, lumber, glass ware, tin plate and brick.

The State Auditor gives the following assessed property valuations for Monongalia county for the years 1910, 1911 and 1912:

|                        | 1910                | 1911                | 1912                |
|------------------------|---------------------|---------------------|---------------------|
| Real Estate .....      | \$29,141,518        | \$30,467,055        | \$31,160,345        |
| Personal Property..... | 8,909,075           | 8,903,178           | 9,059,786           |
| <b>Totals .....</b>    | <b>\$38,050,593</b> | <b>\$39,370,233</b> | <b>\$40,220,131</b> |

The above ranks Monongalia fifth and next to Kanawha in point of wealth among the counties of the State.

A brief description of the incorporated cities and towns will now be given.

### Morgantown.

Morgantown, the county seat of Monongalia, is the largest and most important town in the county. It is located a few miles east of the central portion of the county on the east bank of the Monongahela river, at the mouth of Deckers creek, being largely built on high terraces, or old erosion levels of these two streams, 100 to 150 feet above the river. The first white man to settle at the site of Morgantown was Thos. Decker, concerning whom Wiley gives the following in his History of Monongalia County, pages 570 to 572:

"In the fall of 1758, Thomas Decker and some others commenced a settlement on the Monongahela river at the mouth of what is now Decker's creek.' This account would make their settlement on the site of Morgantown. A tradition, current among old people, makes Decker, escaping from the massacre of his colony by Indians, in 1759, to jump into a rattlesnake den, where he was bitten to death, and locates the affair at the Harner place, some miles up Decker's creek.

"Frontier history and tradition agree in making David and Zackwell Morgan, the next settlers after the Deckers, on the site of Morgantown, in 1768, and the first owners; but Survey Book No. 1 in the Court House makes Isaac Lemasters the first owner, settling in 1772, and selling to Zackwell Morgan the site of Morgantown.

"Zackwell Morgan, supposed to be a relative of Gen. Daniel Morgan, was here in 1766, by Colonel Crawford's sworn statement.

Wither's Border Warfare makes David Morgan to have come in 1768. and also Zackwell. The tradition in the Morgan family makes David to have come first, and Zackwell, his brother, to have followed in 1772 or 1773, when David Morgan left Zackwell in possession of the place and removed to the vicinity of Prickett's Fort (Marion county), where, when sixty years of age, he had his celebrated fight with the Indians. \* \* \* \*

"Zackwell Morgan was of Welsh descent, came from Berkeley county, Virginia, settled for a time on George's creek in Pennsylvania, and then came to the site of Morgantown."

On pages 575 and 576 of the same reference, Wiley adds the following:

"The General Assembly, in October, 1785, established Morgans-Town by an act reading as follows:

"Be it enacted by the General Assembly that fifty acres of land, the property of Zackquell Morgan, lying in the county of Monongalia shall be, and they are hereby, vested in Samuel Hanway, John Evans, David Scott, Michael Kerns and James Daugherty, gentlemen, trustees, to be by them or any three of them laid out in lots of half an acre each, with convenient streets, which shall be, and the same are hereby, established a town by the name of Morganstown.'\*\*\*\*\*

"Morgantown was incorporated on the 3rd day of February, 1838, as 'The Borough of Morgantown,' and seven trustees, to be elected annually, were to administer its municipal affairs. March 20, 1860, an amended charter was secured from the Legislature of Virginia, providing for the election of a mayor, sergeant, five councilmen and a recorder. The boundaries of the borough were declared to be as follows: 'Beginning at the mouth of Deckers creek and running down the Monongahela river with its meanders 96 poles, to where a Spanish oak and sugar tree (stood), the lower corner of Morgan's survey; thence with a line of the same, N 77½°, E 48½ poles to where a black oak stands, now in the North Boundary street; thence along said street S 57½° E 92 poles, crossing the Deep Hollow run to said Morgan's line, and with same S 35½° W 47 poles to a white oak, his corner, and corner to Michael Kern's; and with their lines S 89° 7' W 31 poles to a white oak on a point; S 15° W 16 poles to the mouth of the aforesaid Deep Hollow run at a high rock; thence down Deckers creek with its meanders, and binding therewith, 200 poles to the beginning.'"

In 1901 Morgantown was incorporated as a city and annexed the towns of Seneca, Greenmont and South Morgantown. During the last 10 years it has enjoyed a very rapid growth both in population and in industrial activity. In 1900 the population was only 1895, but the census of 1910 gives it 9,150, a gain of 7,255, or an increase of 382.8 per cent, leading all other towns in the State in that respect. The high rate of gain is due in part to the annexation of the three suburban towns mentioned above in 1901. In order of population it is now the ninth city of the State, ranking next to Clarksburg.

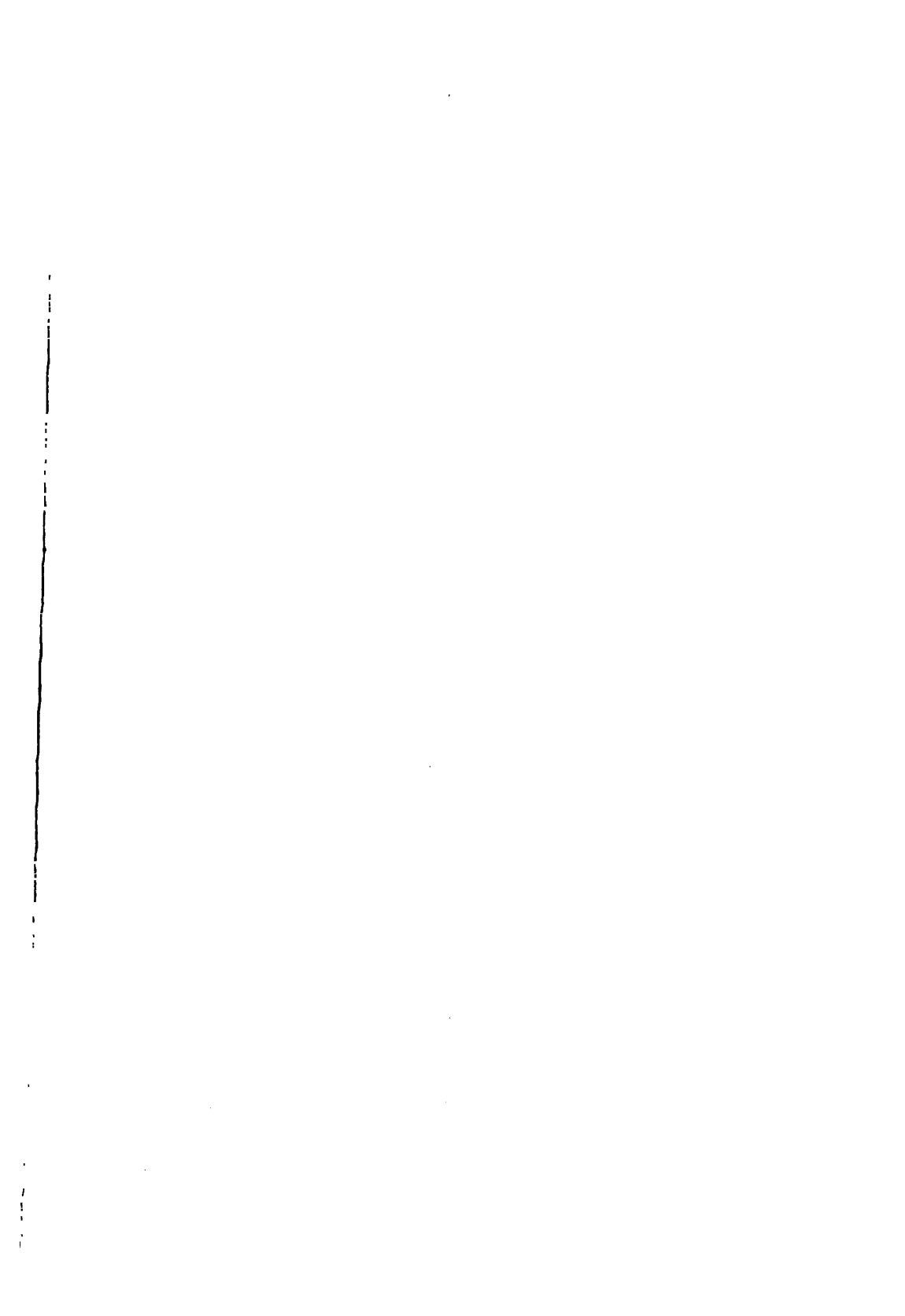




PLATE III.—The Circle, West Virginia University, at Morgantown.

**West Virginia University.**—The State University is situated within the corporate limits of Morgantown. The buildings, thirteen in number, are all located, with the exception of the Central Heating Plant, on a high terrace or old erosion level of the Monongahela river, 140 to 200 feet above the level of the latter stream. The following account of the University is given on page 221 of Vol. I of the W. Va. State Board of Control, published under date, September 30, 1910:

**"History.**—The University is, of course, the chief of all the educational institutions of the State. It was established in 1867, and received at once the benefit of the Land Grant Act, so-called, passed by Congress in 1862. The lands so received were sold for \$90,000.00, which with small additions constitute the present endowment fund of about \$115,000.00. The first faculty consisted of six members. That number has now grown to about seventy-five. There were originally three departments—classical, scientific, and preparatory—including about seventy courses of instruction. There are now more than forty departments, schools and colleges, and between five and six hundred courses of instruction.

**"Location and Organization.**—The University is located within the corporate bounds of the city of Morgantown, Monongalia county. Its campus is beautifully situated on the right bank of the Monongahela river along three different elevations to a maximum height of about three hundred feet above the level of the river bed. It includes about fifty acres. The State Farm, nearby, used by the Experiment Station, is a tract of nearly a hundred acres.

**"The organization of the University embraces:** the college of arts and sciences, including the department of military science; the college of engineering and mechanic arts; the college of agriculture; the college of law; the college of medicine. The following schools are connected with the University: the school of music; the school of fine arts; the summer school; the preparatory school. The Agricultural Experiment Station, supported in the main by the United States Government, is a department of the University. \* \* \*

**"Equipment.**—The equipment of the University consists of thirty-one laboratories in use by the departments needing them, and of furniture, apparatus, and special facilities for instruction distributed among all the departments. In this distribution the following may be specially mentioned: Libraries, including about 40,000 volumes; laboratories for chemistry, geology, botany, bacteriology, physics, anatomy, physiology, histology, pathology, zoology and horticulture; shops for civil, mechanical, electrical, and mining engineering; special plants for such departments as agriculture, physical training, history, mathematics, commerce, fine arts, and veterinary science; equipment for the Experiment Station, and the State Farm, including apparatus, stock, and farm implements."



The following tables, taken from pages 47 and 48 of Vol. II, Part II, show the attendance in the several colleges and schools and the distribution of this attendance among the various departments for the years 1910-11 and 1911-12:

### Enrollment for 1910-1911.

#### The Colleges.

|                    | Candidates for Degrees. |           |           |           |            |            |           | Candidates for Diplomas |          |           | Special  |           |          | Total.    |            |            |            |
|--------------------|-------------------------|-----------|-----------|-----------|------------|------------|-----------|-------------------------|----------|-----------|----------|-----------|----------|-----------|------------|------------|------------|
|                    | Grad.                   | Sen.      | Jun.      | Sophi.    | Fresh.     | Males.     | Females.  | Total.                  | Males.   | Females.  | Total.   | Males.    | Females. | Total.    | Males.     | Females.   | Total.     |
| Arts and Sciences. | 18                      | 39        | 45        | 45        | 97         | 149        | 95        | 244                     | ..       | ..        | ..       | 6         | 5        | 11        | 155        | 100        | 255        |
| Engineering .....  | ..                      | 19        | 14        | 13        | 32         | 78         | ..        | 78                      | ..       | ..        | ..       | 3         | ..       | 3         | 81         | ..         | 81         |
| Agriculture .....  | ..                      | 3         | 4         | 4         | 4          | 15         | ..        | 15                      | ..       | ..        | ..       | 2         | ..       | 2         | 17         | ..         | 17         |
| Law .....          | ..                      | 5         | 15        | 20        | 5          | 45         | ..        | 45                      | 4        | ..        | 4        | 25        | ..       | 25        | 74         | ..         | 74         |
| Medicine .....     | ..                      | 1         | 3         | 7         | 6          | 17         | ..        | 17                      | ..       | ..        | ..       | ..        | ..       | 17        | ..         | 17         |            |
| <b>Total.....</b>  | <b>18</b>               | <b>67</b> | <b>81</b> | <b>89</b> | <b>144</b> | <b>304</b> | <b>95</b> | <b>399</b>              | <b>4</b> | <b>..</b> | <b>4</b> | <b>36</b> | <b>5</b> | <b>41</b> | <b>344</b> | <b>100</b> | <b>444</b> |

#### The Schools.

|   |            |            |            |    |    |
|---|------------|------------|------------|----|----|
| The School of Fine Arts.....                              | ..         | ..         | 9          | .. | 9  |
| The School of Music.....                                  | 6          | 52         | 58         | .. | .. |
| The Commercial School.....                                | 1          | 16         | 19         | .. | .. |
| The Summer School.....                                    | 67         | 204        | 271        | .. | .. |
| The Preparatory School.....                               | 79         | 21         | 108        | .. | .. |
| The School of Agriculture.....                            | 11         | ..         | 11         | .. | .. |
| <b>Total.....</b>   | <b>164</b> | <b>304</b> | <b>468</b> | .. | .. |
| Irregular Students in Music.....                          | 9          | 72         | 81         | .. | .. |
| Music .....   | ..         | 8          | 8          | .. | .. |
| Art .....   | ..         | 65         | 65         | .. | .. |
| Physical Training.....                                    | 54         | 7          | 61         | .. | .. |
| Short Course in Agriculture.....                          | 20         | 19         | 39         | .. | .. |
| School of Sunday School Methods.....                      | 4          | 11         | 15         | .. | .. |
| <b>Total.....</b>   | <b>87</b>  | <b>182</b> | <b>269</b> | .. | .. |
| Entire enrollment at Morgantown.....                      | 251        | 486        | 737        | .. | .. |
| Additional enrollment in Agricultural Extension Schools.. | ..         | ..         | 245        | .. | .. |
| <b>Grand Total.....</b>                                   | ..         | ..         | <b>982</b> | .. | .. |

**Enrollment for 1911-1912.**  
**The Colleges.**

|  | Candidates for Degrees. |           |           |            |            |            |            | Special.   |           |          | Total.    |            |            |             |
|--|-------------------------|-----------|-----------|------------|------------|------------|------------|------------|-----------|----------|-----------|------------|------------|-------------|
|  | Grad.                   | Sen.      | Jun.      | Soph.      | Fresh.     | Males.     | Females.   | Total.     | Males.    | Females. | Total.    | Males.     | Female.    | Total.      |
| Arts and Sciences...   | 16                      | 45        | 36        | 56         | 126        | 177        | 102        | 279        | 10        | 4        | 14        | 187        | 106        | 293         |
| Engineering .....  | ..                      | 17        | 11        | 20         | 36         | 84         | ..         | 84         | 3         | ..       | 3         | 87         | ..         | 87          |
| Agriculture .....  | 2                       | 6         | 5         | 8          | 15         | 36         | ..         | 36         | ..        | ..       | ..        | 36         | ..         | 36          |
| Law .....  | 1                       | 14*       | 14*       | 21*        | ..         | 50         | ..         | 50         | 13        | ..       | 13        | 63         | ..         | 63          |
| <b>Total</b> .....   | <b>19</b>               | <b>82</b> | <b>66</b> | <b>105</b> | <b>177</b> | <b>347</b> | <b>102</b> | <b>449</b> | <b>26</b> | <b>4</b> | <b>30</b> | <b>373</b> | <b>106</b> | <b>479</b>  |
| <b>The Schools.</b>  |                         |           |           |            |            |            |            |            |           |          |           |            |            |             |
| The School of Music.....                                     |                         |           |           |            |            |            |            |            |           |          |           | 6          | 107        | 113         |
| The Preparatory School.....                                  |                         |           |           |            |            |            |            |            |           |          |           | 48         | 14         | 62          |
| The School of Fine Arts.....                                 |                         |           |           |            |            |            |            |            |           |          |           | 1          | 14         | 15          |
| The School of Agriculture and Home Economics.....            |                         |           |           |            |            |            |            |            |           |          |           | 19         | 3          | 22          |
| The Summer School.....                                       |                         |           |           |            |            |            |            |            |           |          |           | 77         | 206        | 283         |
| The School of Methods for Sunday School Workers.....         |                         |           |           |            |            |            |            |            |           |          |           | 3          | 16         | 19          |
| The Farmers Course.....                                      |                         |           |           |            |            |            |            |            |           |          |           | 40         | ..         | 40          |
| The Winter Course in Home Economics.....                     |                         |           |           |            |            |            |            |            |           |          |           | ..         | 35         | 35          |
| The Night Classes.....                                       |                         |           |           |            |            |            |            |            |           |          |           | 12         | 13         | 25          |
| <b>Total</b> .....   |                         |           |           |            |            |            |            |            |           |          |           | <b>206</b> | <b>408</b> | <b>614</b>  |
| Entire Enrollment at Morgantown.....                         |                         |           |           |            |            |            |            |            |           |          |           | 579        | 514        | 1093        |
| Additional Enrollment in Agricultural Extension Schools..... |                         |           |           |            |            |            |            |            |           |          |           | 265        | 167        | 432         |
| <b>Grand Total</b> .....                                     |                         |           |           |            |            |            |            |            |           |          |           | <b>844</b> | <b>681</b> | <b>1525</b> |

\*Students in the College of Law are known as Third-year, Second-year, and First-year Students.

**Glass Industries.**—Morgantown is the leading glass manufacturing town in the State. Nine different plants are situated within the corporate limits, or in the vicinity thereof. All the concerns have located there during the last 16 years, having been attracted by the low price of natural gas offered for manufacturing purposes. A brief account will now be given of each plant from data collected by Mr. Reger:

**Seneca Glass Company, Factory A.**—This plant and its main office are located near the Baltimore & Ohio R. R. in the Fourth Ward. It was the first glass factory in Morgan-

town. According to C. F. Boehler, Secretary and Treasurer of the Company, the plant was established in 1896. The articles manufactured are lead blown bar and table ware, and the capacity of the concern is two to three carloads weekly. No machines are used, all ware being hand blown. Sand from Berkeley Springs, W. Va., and Hancock, Md., is used. It is a 14-pot factory, furnishing employment for 250 persons—150 men, 50 boys and 50 girls—100 of whom are skilled workers. The pay roll averages \$10,000 to \$12,000 monthly, and the plant operates during the entire year.

**Seneca Glass Company, Factory B.**—This plant is owned by the same company, and is located in Star City, 2 miles below the corporation line of Morgantown. The factory first started to operate in August, 1911, and makes lime blown tumblers. It has two 6-ring tanks, only one of which was in operation in March, 1912. Employment is furnished under these conditions for 80 persons, but the latter figure will be increased to 200 when it is in full operation. All ware is hand blown, no machines being used. The sand utilized is obtained from the same source as that for Factory A, given above, and the lime from Martinsburg, W. Va., and Toledo, Ohio.

**W. R. Jones Glass Company.**—The W. R. Jones Glass Company plant and head office are located along the Baltimore & Ohio R. R. in the Fourth Ward. According to Chas. Palmer, Supt., it was established in 1901, and manufactured up to 1912 hand blown window glass exclusively. The capacity of the plant is 25,000 boxes monthly. The sand utilized is obtained from the Sturgisson quarry in the Upper Connoquenessing sandstone of the Pottsville series, on Deckers creek, Monongalia county, 5½ miles southeast of Morgantown; and the lime, from Martinsburg, W. Va. Employment is furnished for 250 men, 175 of whom are skilled workmen. The pay roll is \$250,000 yearly. This factory operates only ten months in the year, generally shutting down during the hot months of July and August.

During 1912 the plant changed from hand to machine blown ware by the installation of Jones Machinery & Glass Company machines. Under these new conditions the capacity

is 1000 boxes daily: the number of employees, 200, of which 100 are skilled; and the pay roll about the same as before.

**Marilla Window Glass Company.**—This plant is located along the Morgantown & Kingwood Railroad on the east side of the "Peninsula" in the 2nd Ward. The main office is also in Morgantown. According to H. A. Limpert, Manager, and J. L. Keener, President, it was established in 1902, and up to 1912 manufactured hand blown window glass exclusively. The capacity of the plant is 150,000 square feet, or 3,000 boxes weekly. The sand utilized is obtained from the Sturgisson quarry mentioned above, and the lime from Martinsburg, W. Va. Employment is furnished for 250 men, 150 of whom are skilled workmen. The pay roll averages \$12,000 to \$15,000 monthly. When running at full capacity, 700,000 to 800,000 cubic feet of natural gas is consumed daily. The plant operates only 8 months of the year, shutting down during the hot months to renew the tank lining.

During 1912 this plant also changed from hand to machine blown ware by the installation of 6 Jones Machinery & Glass Company machines of 5 blowers each. Under these new conditions, the capacity is 200,000 boxes yearly; number of employes, 200, of which 60 are skilled; and the pay roll, \$100,000 yearly.

**Mississippi Glass Company.**—The plant of this company is located in the First Ward along the Baltimore & Ohio Railroad, near the southwest edge of Morgantown. The principal office of the company is in New York City. According to H. L. Carspecken, Manager, the plant was established in 1902. It manufactures wired, figured and skylight glass, having a daily capacity of 40 tons. The sand utilized comes from Berkeley Springs, Morgan county, and the Sturgisson quarry in Monongalia county; and the lime from Martinsburg, Berkeley county. Employment is furnished for 175 persons, mostly men, about one-half of whom are skilled workmen. The glass is machine rolled. The pay roll is \$150,000 yearly.

**Pressed Prism Plate Glass Company, Sabraton Works.**—This plant is located along the Morgantown & Kingwood R. R., three-fourths mile southeast of Morgantown. The main office is in Chicago, Illinois. According to M. A. Ross,

Asst. Manager, the factory was established in 1903, and it manufactures plate glass specialties, ornamental plate, prism plate, and also some rough plate, having a daily capacity of 5,000 square feet. It has two continuous tank furnaces, five plate glass grinding and polishing machines, and special casting machinery patented by this firm, not used elsewhere. The sand utilized comes from the Sturgisson quarry; the lime, from Tiffin, Ohio; the soda, from Barberton, Ohio; the nitre, from Chile; the manganese, from Saxony; and the powdered emory for grinding purposes, from North Grafton, Mass. Employment is furnished for 100 men, 10 of whom are skilled workmen. The pay roll is \$5,000 monthly. The plant runs during the entire year. Natural gas is used for fuel, of which one-half million cubic feet is required daily.

**Star Glass Company.**—This plant is located 2 miles northwest of Morgantown at Star City, at which place is also located its main office. According to W. J. Wambaugh, Sec. and Treas. for the company, the factory was established in December, 1904, and it manufactures lamp chimneys, gas globes and electric shades. All ware is hand blown. The capacity is five carloads weekly. The equipment includes three day tanks which are about equivalent to a 12-pot furnace. The sand utilized comes from Berkeley Springs, Morgan county; and the lime, from Huntington, Indiana. Employment is furnished for 180 persons—135 men, 20 women and 25 boys—100 of whom are skilled workers. The pay roll is \$2,500 weekly. The plant is in operation 10½ months of the year, generally from August 15th to July 1st.

**Union Stopper Company.**—The plant and head office of this company are located along the Baltimore & Ohio R. R. in the Fourth Ward of Morgantown. According to P. J. Beaumont, Gen'l Manager, this factory was established in 1905, and it manufactures a general line of glass ware such as table ware, stationer's goods, and electric lighting glass ware. All ware, lime glass, hand blown and pressed. The output is about \$150,000 worth annually. The equipment includes a 14-pot furnace. The sand utilized comes from Berkeley Springs, Morgan county; the lime, from Tiffin, Ohio; and the soda ash, from Detroit, Mich. Employment is fur-

nished for 175 persons—50 per cent men; 30 per cent boys; and 20 per cent girls—40 per cent of whom are skilled workers. The average pay roll is \$6,400 monthly. The plant runs 11 to 12 months of the year.

**Economy Tumbler Company.**—This plant and its head office are located along the Baltimore & Ohio R. R. in the Fourth Ward of Morgantown. According to W. E. Hunter, President and Manager, the factory was established in 1906, and it manufactures table glass ware, having an output of \$400,000 worth annually. All ware is hand blown. The equipment includes a 24-pot furnace. The sand utilized comes from Berkeley Springs, Morgan county; and the lime, from Huntington, Indiana. Employment is furnished for 400 persons—50 per cent, men; 15 per cent, boys; and 35 per cent, women—of whom all but about 5 per cent are skilled workers. The plant is in operation generally 50 weeks during the year. The pay roll for the year 1911 was \$245,000 exclusive of the salaries of the officers.

**Crystal Tumbler Company.**—This plant and main office are located along the Baltimore & Ohio R. R. in the Fourth Ward of Morgantown. According to E. B. Stone, Sec. and Treas., this company was incorporated March 14, 1910, and operations begun in August, 1911. It manufactures lime flint glass tumblers, pitchers, bar ware, etc. The output is 75 barrels daily, but when running at full capacity, 125 barrels. All ware is hand blown. The equipment includes an 8-ring continuous tank. The sand utilized comes from Berkeley Springs, Morgan county; and the lime, from the States of Ohio and Indiana. Employment is furnished for 200 persons—125 men, 25 boys, 50 women—150 of whom are skilled workers. The monthly pay roll is \$7,000, and the shipments for March, 1911, amounted to \$11,600. The plant expects to operate 50 weeks during the year.

**S. R. Wightman Glass Company.**—This plant is located along the Morgantown & Kingwood R. R. on Deckers creek, one-half mile southeastward from the corporation line of Morgantown. It started in December, 1905, but owing to financial difficulties, it was compelled to shut down in May, 1910, and has not since resumed operations. It is now owned

by the Farmers & Merchants Bank of Morgantown. The buildings and grounds were purchased by the Wightman interests from the West Virginia Bottle and Glass Company. It manufactured glass bottles exclusively. The "Industrial Edition" of the New Dominion, Morgantown, W. Va., edited and compiled by Chas. J. Holmes, under date, May, 1906, gives the equipment and other data of this factory as follows:

"There are three bottle machines running two shifts per day, and each machine has a capacity of four carloads per week, making a weekly output of twelve cars. There are three lehrs and six shops. There are three men and three boys employed on each shop, and the shops average twenty gross to the shift. There are two shifts for each day of the week, and the amount of material that is turned out is enormous. At the Sabraton plant there are two tanks, but at the present time but one of them is in operation. The second tank is being overhauled and it will be placed in operation at no great distance in the future. With one tank running, there are 150 men employed and this number will be increased to 300 when both tanks are running full."

**Miscellaneous Industries.**—In addition to the glass industry, there are several other important factories in Morgantown that deserve special mention. A brief account will now be given of these from data collected by Mr. Reger:

**American Sheet & Tin Plate Company—Sabraton Works**

This plant is located along the Morgantown & Kingwood R. R. on Deckers creek, one mile southeastward from the corporation line. The stock of this company is held by the United States Steel Corporation. According to W. C. Loyd, Manager of the Sabraton Works, the latter was established in 1905, and it manufactures tin and terne plate. It is a ten-mill plant, having a weekly output of 900 tons. Employment is furnished for 750 persons, 40 to 50 of whom are girls. With the exception of 50 employes, all labor is skilled or semi-skilled. The plant operates the year round, and the pay roll averages \$60,000 monthly. Natural gas is largely used for fuel, the consumption of which reaches 65,000,000 cubic feet monthly, the same being furnished by the West Virginia Traction and Electric Company of Morgantown, at the rate of 6 cents a thousand cubic feet in summer months and 8 cents in winter months.

**Chrisman & Goodwin Foundry.**—This plant is located



PLATE IV.—Sabraton Works, American Sheet & Tinplate Company, Sabraton, Monongalia County.





in the First Ward along the Baltimore & Ohio R. R., and is operated by Robt. R. Chrisman and Geo. R. Goodwin, both of Morgantown. According to Mr. Chrisman, the factory was established Nov. 1st, 1909. It manufactures gray iron and brass castings on special orders, doing jobbing work only. The capacity of the plant is 7 tons daily. Employment is furnished for 16 men, 12 of whom are skilled workmen. The sand utilized for moulding purposes comes from an old river terrace deposit on the Reed farm near Star City, Monongalia county. It runs the year round, and has a monthly pay roll of \$1,500. The value of the yearly output is \$40,000. The company has recently acquired a new site on the west side of the Monongahela, opposite Morgantown, and will erect in the near future a much larger plant fronting both on the river and Buckhannon and Northern Railway (P. & L. E.)

**Lough Bros. Carriage Factory.**—This plant is located in the Fourth Ward of Morgantown. According to data given by J. M. Lough, the factory was established in 1891. It manufactures wagons, carriages and drays, having an output of 40 to 50 yearly. Employment is furnished for 5 persons, all of whom are skilled workmen.

**Morgantown Brick Company.**—This company has two plants one of which is located in the Fourth Ward of Morgantown, and the other on the opposite side of the river. The former is the only one in operation at this time, and it makes paving brick exclusively. According to S. S. Minor, Superintendent, employment is furnished for 35 to 40 men, and the monthly pay roll ranges from \$1,700 to \$1,900. A further description of this plant is given in the chapter on Clays.

### Westover.

Westover is another important suburb of Morgantown, located opposite on the west side of the Monongahela river. It was incorporated as the City of Westover on October 12, 1911. An enumeration, taken August 18, 1911, gives the population as 521. The city as limited by the corporate lines fronts on the river for about a mile, and includes a boundary

of 287.44 acres. The Buckhannon & Northern Branch of the Pittsburgh & Lake Erie R. R. passes through it from Fairmont to Pittsburgh. It is connected with Morgantown by the new highway bridge over the Monongahela, and two separate trolley lines.

### **Riverside.**

Riverside fronts on the west side of the Monongahela river and extends from the western boundary of Westover westward to Dents run, including within its corporate limits 202.4 acres. It was incorporated as the Town of Riverside on April 6, 1912; the census figures accompanying the papers of incorporation, dated February 27, 1912, give the population therein as 182, and the number of legal voters as 61. It is connected with Morgantown by two trolley lines and the B. & N. R. R.

### **Star City.**

Star City is located on the east bank of the Monongahela river, opposite the mouth of Scott run, 2 miles northwest of Morgantown. It was incorporated May 17, 1907, as the Town of Star City, and includes a boundary of 291 acres. The census of 1910 gives its population as 318. Almost its entire growth has taken place since 1900. It is largely populated by glass workers, since two of the glass plants described on preceding pages are located here.

### **Blacksville.**

Blacksville, the largest town of Clay district, Monongalia county, is located on the north bank of Dunkard creek near the northwest corner of the district. It was incorporated as the Town of Blacksville by an act of the General Assembly of Virginia, passed on February 3, 1830. A plat of the town as laid out by David Black, from whom the village was named, is recorded on page 312 of Deed Book No. 11, Old Series, in the Office of the County Clerk at Morgantown. In 1900 its population was 180, but the census of 1910 gives it 204.

In addition to the above described incorporated towns for Monongalia county, the following is a list of villages therein, the most of which are merely cross-road towns with one or more stores and a post office. Space will not permit a more detailed account of these towns. The Census Bureau of Washington, D. C., does not give the population of unincorporated towns; hence, the population as given below is as estimated by the postmaster of each place in May, 1912. Those in black face type are largely coal mining villages:

| Population.              |     | Population.                    |      |
|--------------------------|-----|--------------------------------|------|
| 1912.                    |     | 1912.                          |      |
| Beechwood .....          | 150 | McCurdyville (Center P. O.) .. | 30   |
| Bula .....               | 40  | Opekiska .....                 | 95   |
| Cassville .....          | 100 | Pentress .....                 | 100  |
| Charlotte .....          | 42  | Randall (Jintown) .....        | 52   |
| Core .....               | 25  | Richard .....                  | 250  |
| Crossroads .....         | 31  | Sabraton .....                 | 2200 |
| Daybrook .....           | 110 | Saint Cloud .....              | 15   |
| Dellslow .....           | 100 | Statler Run .....              | 40   |
| Easton .....             | 60  | Stewartstown .....             | 50   |
| Laurel Ironworks .....   | —   | Uffington .....                | 50   |
| Laurelpoint .....        | 77  | Vanvoorhis .....               | 29   |
| Little Falls .....       | 35  | Wadestown .....                | 52   |
| Maidsville Landing ..... | 36  | Wana (Wise) .....              | 200  |
| Mona (Granville) .....   | 350 | Whiteday (Smithtown) .....     | 44   |

MARION COUNTY.

Marion county is bounded on the north by Monongalia county; on the east by Monongalia and Taylor; on the south by Taylor and Harrison; on the west by Wetzel. Its area as determined by planimeter from the accurate topographic sheets of the U. S. Geological Survey, by districts, is as follows:

| Districts.             | Sq. Miles. |
|------------------------|------------|
| Mannington .....       | 100.09     |
| Pawpaw .....           | 39.76      |
| Lincoln .....          | 56.63      |
| Fairmont .....         | 20.69      |
| Grant .....            | 25.44      |
| Winfield .....         | 39.61      |
| Union .....            | 31.33      |
| Total for county ..... | 313.55     |

Marion county, according to Lewis<sup>3</sup>, was formed from Monongalia county by an act of the Assembly of Virginia, passed January 14, 1842, and was named in honor of General Francis Marion of Revolutionary fame.

The general surface of the county varies in elevation from 847.33 feet above tide—normal elevation of Pool No. 14 of the U. S. Government's lock and dam system for the Monongahela river—to 2003 feet above the same datum at the cross-roads in the extreme eastern point of the county, a range in elevation of 1156 feet.

**Population.**—In 1900 the population was 32,430, of which 31,942 were white; 482, colored; and 1,769, foreign born. The census of 1910 gives the total population as 42,794, a gain of 10,364, or an increase of 31.9 per cent. The following table exhibits the changes in population in Marion county by magisterial districts during the last two decades, as determined by the Census Bureau at Washington, D. C.:

| Districts—Marion County.   | Population.  |              |              |
|--|--------------|--------------|--------------|
|  | 1910         | 1900         | 1890         |
| Mannington, including Mannington city.....   | 8050         | 7350         | 5605         |
| Pawpaw, including Fairview and Rivesville towns .....                              | 4239         | 2636         | 2311         |
| Lincoln, including Farmington and Worthington towns and part of Monongah town..... | 6278         | 4082         | 2982         |
| Fairmont, including Barnstown village and wards 2 and 5 of Fairmont city.....      | 11780        | 7034         | 3228         |
| Grant, including part of Monongah town.....  | 4885         | 4864         | 2085         |
| Winfield .....   | 2391         | 3127         | 2191         |
| Union, including ward 1 of Fairmont city.....                                      | 5171         | 3337         | 2319         |
| <b>Totals for county.....</b>  | <b>42794</b> | <b>32430</b> | <b>20721</b> |

A glance at the above table will show that by far the greatest increase in population from 1900 to 1910 in Marion county has taken place in the oil and gas, and the coal mining districts of the county, due largely to the influx of labor incident to the development of these mineral resources. Winfield district which has had no new coal mines, and no oil and gas development, shows a loss during the same period of 23½ per cent. Another cause of increase in Fairmont and Union

3. History of West Virginia, page 675, V. A. Lewis; 1889.

districts has been the rapid industrial growth of the city of Fairmont.

**Products.**—The principal farm products of Marion county are corn, wheat, oats, hay, potatoes, garden vegetables, apples, peaches, dairy products, beef cattle, sheep and poultry.

The principal mineral and manufactured products are coal, coke, petroleum, natural gas, building stone, glass ware, china pottery, wall plaster, brick, mining machinery and lumber.

The State Auditor gives the following assessed property valuations for Marion county for the three years ending with 1912:

|                         | 1910.               | 1911.               | 1912.               |
|-------------------------|---------------------|---------------------|---------------------|
| Real Estate.....        | \$33,405,795        | \$34,585,270        | \$35,582,955        |
| Personal Property ..... | 10,600,405          | 10,767,585          | 11,000,440          |
| Totals .....            | <u>\$44,006,200</u> | <u>\$45,352,855</u> | <u>\$46,583,395</u> |

Marion, according to the above, ranks third in point of wealth among the counties of the State, Ohio coming first and Harrison second.

The incorporated town in the county are as follows: Fairmont, Mannington, Monongah, Fairview, Barnstown, Farmington (Underwood), Worthington and Rivesville.

### Fairmont.

Fairmont, the county seat of Marion county, is the largest and most important city in the county. It is located along both banks of the Monongahela river, one-half mile north-eastward from the junction of West Fork and Tygart Valley rivers, being principally on high terraces or old erosion levels of the Monongahela river, 150 to 200 feet above the stream, and was incorporated as a city, February 18th, 1899. On pages 675 and 676 of his History of West Virginia, Lewis says:

"Fairmont, then called 'Middletown,' in Monongalia county, was established a town, by act of Assembly, January 19, 1820, on lands of Boaz Fleming, with John S. Barnes, John W. Kelly, Josiah Wolcott, John H. Polsley, Jesse Ice, Benoni Fleming and Thomas Fleming, trustees. By an act of February 4th, 1843, the name was changed from Middletown to Fairmont."

During the period from 1900 to 1910, it has enjoyed a very rapid growth both in population and in industrial activity. In 1900 the population was only 5,655, but the census of 1910 gives it 9,711, a gain of 4,056, or an increase of 71.7 per cent. It is now the seventh city of the State, having 510 more people than Clarksburg, the eighth city; and 987 less than Martinsburg, the sixth.

**State Institutions.**—Fairmont has two State institutions located within its corporate limits; viz., Fairmont State Normal School, and Miners Hospital No. 3.

**Fairmont State Normal School.**—The grounds and buildings of this school are located along Fairmont Avenue in the southwest portion of Fairmont. It is maintained by the State largely as a school for the training of public school teachers. The following account of this institution is given on pages 285 and 286 of Vol. I of the West Virginia State Board of Control:

**History.**—The Fairmont State Normal School began its existence in 1865, as an enterprise of the citizens of Fairmont. In 1867, the Legislature united with the town in the construction of a building, which for a long time was used by the State Normal School and the Fairmont public schools jointly. Its first President was Dr. J. B. Blair, who served until 1878. The ability of Dr. Blair and the splendid management of the institution gave it a most excellent standing, especially in the northern end of the State.

**Grounds and Buildings.**—In 1893, the school was moved into its present grounds and building. The grounds consist of a single block, fronting on Fairmont Avenue. This land was obtained at a nominal price, in 1892, when the section of Fairmont in which the school is now located was just beginning to build up; it is now very valuable.

“There are two buildings for the use of the school.

“First, the school building erected in 1893. This building is constructed of red brick with stone sills and lintels. It is well proportioned and presents an imposing appearance. It has a frontage of 100 feet, with a depth of 150 feet.

“The basement contains gymnasium rooms for ladies and gentlemen, janitor’s room, storage rooms, and rooms for the heating apparatus.

“The first story contains four recitation rooms for the teachers of French and German, of Mathematics, of English Language and Literature, of History and Civics, the Physics and Chemical Laboratory, and a room for the Training School. These comprise the kindergarten room (the children of the grades), school room and the lecture room for the Training School teachers.

“The second story contains an attractive chapel which is used for morning exercises and as a daily study hall, the rooms of the teachers of Latin, of the Assistant in English, of the Art Teacher, also the Library, the offices of the President, and the First Assistant.



PLATE V.—Fairmont State Normal School.





"The third story contains the large auditorium, one of the most attractive and satisfactory assembly halls in the State. It is capable of seating 1000 people. It is furnished with opera chairs, and as one of its ornaments, has a grand concert piano. Also on the third floor is the private instruction room of the teacher in instrumental music, and two large halls for the Mozart and Lyceum societies.

"The building is not well constructed, and is entirely insufficient to meet the demands of the school.

"The other building is a dormitory for women. This is an attractive three-story building, adjoining the Normal building, containing kitchen, pantry, large dining-room with seating capacity for forty-four, rooms for the house-keeper and family, seven large rooms for teachers, and twenty-two rooms for women students, besides parlors, study hall and reception halls. \* \* \* \* \*

**Statistical Tables, 1910-1912.**

From Vol. II, Part II, W. Va. State Board of Control, pp. 145-146.

**Table No. 1.**  
Enrollment, 1910-1911.

|                    | Senior. | Junior. | Sophomore. | Freshman. | Saturday Students. | Summer School (New). | Males. | Females. | Total. |
|--------------------|---------|---------|------------|-----------|--------------------|----------------------|--------|----------|--------|
| Normal Course..... | 77      | .....   | .....      | .....     | .....              | .....                | .....  | .....    | .....  |
| Academic .....     | 11      | .....   | .....      | .....     | .....              | .....                | .....  | .....    | .....  |
| Total.....         | 88      | 63      | 156        | 237       |                    | 49                   | 159    | 434      | 593    |

**Table No. 2.**  
Enrollment, 1911-1912.

|                    | Senior. | Junior. | Sophomore. | Freshman. | Saturday Students. | Summer School (New). | Males. | Females. | Total. |
|--------------------|---------|---------|------------|-----------|--------------------|----------------------|--------|----------|--------|
| Normal Course..... | 87      | .....   | .....      | .....     | .....              | .....                | .....  | .....    | .....  |
| Academic .....     | 9       | .....   | .....      | .....     | .....              | .....                | .....  | .....    | .....  |
| Total.....         | 96      | 56      | 110        | 202       | 30                 | 31                   | 191    | 334      | 525    |

**Miners Hospital Number Three.**—This institution is located on Guffey street in First Ward of Fairmont, and is one of three such hospitals maintained by the State for injured miners. On page 133 of the above mentioned volume, is given the following account of the same:

"The site was the gift of the citizens of that City. The Hospital was opened October 1, 1901, with a capacity for about thirty patients, which has been increased so that there is now room for fifty. The admission of patients to the Hospital has increased steadily year by year.

"The grounds comprise an area of one acre, fronting on Guffey street in the First Ward of the city of Fairmont, easy of access, about four blocks from the B. & O. Railroad station, with water, gas, electric lights and an excellent sewerage system. The grounds have perfect drainage, paved walks and roadways that are lighted with electricity.

"The main building is of two stories with finished basement, is of stone foundation, red brick walls, with corner finish of buff shale brick, slate roof."

On pages 135-141 of the same reference are given statistical tables showing nationality of those admitted, occupation, civic conditions, race and nature of injuries of all patients treated from Oct. 1, 1908, to Sept. 30, 1910.

**Glass Industries.**—Fairmont is also an important glass producing city having five separate factories, the comparatively low price of natural gas offered manufacturers having been instrumental in bringing the plants there. A brief description will now be given of the same from data collected by Mr. Reger:

**Fairmont Bottle Company.**—This is Fairmont's oldest glass factory and it is located in the southwest portion of the city. According to Robert Johns, Manager, the head office is at Fairmont, and the plant was established in 1892. It makes both flint glass bottles and jars. Its specialty is milk bottles. The ware is both hand and machine blown. Teeple and Johnson machines are used; capacity, 4 carloads weekly. The sand comes from Berkeley Springs, Morgan county, and from Hancock, Md., the lime from Ohio (that from Martinsburg, W. Va., being considered too dark for the purpose), and the soda, from Michigan. Employment is furnished for 50 to 60 persons, 30 of whom are skilled workers.

**Monongah Glass Company.**—This plant and its main of-



PLATE VI.--Miner's Hospital No. 3, at Fairmont.



2

1000  
1000  
1000  
1000  
1000



PLATE VII.—Owens West Virginia Bottle Works, Fairmont.



factories are located in the southwestern portion of Fairmont. According to H. L. Heintzelman President, it was incorporated in December, 1903, and started to operate in August, 1904. It makes pressed and blown tumblers, stem ware and kindred lines; capacity, 900 barrels daily. All ware is hand blown, no machines being used, makes both lime and lead flint glass. The sand comes from Hancock, Maryland, the lime from Ohio, and 800 persons—550 men, 125 boys and 125 girls—275 of whom are skilled workers, are employed.

**Fairmont Window Glass Company.**—This plant is located along the "Belt Line" in the southwestern portion of Fairmont. According to O. A. Wood, President, it was established in 1905, and has its principal office in Fairmont. It manufactures hand-blown window glass exclusively, and has a capacity of 3,000 boxes weekly. The sand comes from Dunbar, Pa., and the lime from Martinsburg. Employment is furnished for 150 persons, all men, 77 of whom are skilled workmen.

**Cumberland Glass Company.**—This plant is also located along the "Belt Line" in the southwest portion of Fairmont, but when visited by Mr. Reger in October, 1911, it was shut down. According to Granville Greathouse, caretaker at that time, it was first run under the name, "National Glass Company." Wm. George & Bros. of Pittsburgh are agents for the company. It manufactures tumblers, stem ware, etc., and about 150 persons—men, boys and girls—were employed.

**Owens W. Va. Bottle Company.**—This plant is located on the east side of the Monongahela river, at the southeast edge of Fairmont. According to data given by S. S. Cochrane, Supt., it was established in 1910, and has its head office at Toledo, Ohio. It manufactures machine blown bottles exclusively, having a capacity of 400,000 gross yearly. The sand comes from Hancock, Md., and the lime, from Toledo, Ohio. The special Owens Bottle Machine is used, and 200 persons—all men—50 of whom are skilled workmen, are employed.

**Miscellaneous Industries.**—In addition to the glass business, there are several other industries located in or near



Fairmont. A short description of the same will now be given from data collected by Mr. Reger:

**Fairmont Wall Plaster Company.**—This plant is located along the "Belt Line" in the southwest portion of Fairmont. According to W. T. Block, Secretary, it was established in 1901, and has its principal office in Fairmont. It manufactures Rock wall plaster and cement building blocks. The sand comes from the Monongahela river, and the calcine, from the State of Ohio. The capacity of the plant is 25 tons daily, and 20 persons, 5 of whom are skilled workers, are employed.

**Helmick Foundry-Machine Company.**—This plant is located along the "Belt Line" in the southwestern portion of Fairmont. According to Fred Helmick, Gen'l Manager, this factory was established in 1901, and it manufactures coal mine and coke plant equipment. The sharp sand used comes from the Lilly quarry near Colfax, and the loam sand from the Monongahela river flood plain at Fairmont, near high water level, and 50 persons, 75 per cent of whom are skilled workmen, are employed.

**Mountain City Stone & Foundry Company.**—This plant is also located along the "Belt Line" in the southwest portion of Fairmont. According to W. E. Means, Superintendent, the factory was established in 1905, and it manufactures glass moulds and general foundry products. The foundry sand comes from the Monongahela river flood plain, near the railroad in Fairmont, and 5 persons, 4 of whom are skilled workmen, are employed.

**Fairmont Mining Machinery Company.**—This plant is located in the same portion of Fairmont as that last described. According to H. B. Hungerford, Superintendent, this factory was established June 1st, 1906, and it manufactures mining machinery and supplies. Employment is furnished for 200 persons.

**West Virginia Metal Culvert Company.**—This plant is located on the east side of the Monongahela river, at the southeast edge of Fairmont. According to Edward Limburg, formerly a manager of the concern, it was established in 1907, and manufactures corrugated metal road culverts. It was not





PLATE VIII.—Topography of the Monongalia Series at Hoult, Marion County. Lock No. 15 of Monongahela River in foreground. Photo by Ray Bricker.

in operation when visited by Mr. Reger in October, 1911. When running full, 5 men, all skilled workmen, are employed.

**Reeves Handle Works.**—This plant is located in the same portion of Fairmont as that last described. According to data given by J. W. Reeves, owner, this factory was established in 1909, and manufactures straight wooden handles of all kinds, single-trees, neck-yokes, breast-yokes, ladders, telephone pins, etc., and employs 4 men, all of whom are skilled workmen.

**The Willetts Company.**—This plant is located on Hickman run, one mile southeast of the B. & O. R. R. station at Fairmont, and is engaged in the manufacture of clay products for glass factories. It was established in 1887 and reorganized June 15, 1909, having its principal office in Pittsburgh, Pa. Both domestic and imported fire clays are utilized, and the product is both machine and hand made, giving an annual capacity of 5,000 tons, employment for 25 men, and a monthly pay roll of \$1,000.00. The factory runs 12 months in the year, but in January, 1913, it was not yet in full operation.

### Mannington.

Mannington, the second largest city of Marion, is located in the west central portion of the county on Buffalo creek, and the main line of the Baltimore & Ohio R. R. It was incorporated as a town March 4, 1856, and as the City of Mannington in 1905. In 1900 its population was 1,681, and 2,672 in 1910, a gain of 991, or an increase of 58.9 per cent. Its rapid growth during the last two decades has been largely due to the development of the great oil and gas fields in the surrounding region, the South Penn Oil Company, a former subsidiary concern of the Standard Oil Company of New Jersey, having extensive shops here.

**Homewood Pottery Company.**—This plant is located along the Baltimore & Ohio Railroad, one-fourth mile east of Mannington. According to Geo. W. Bowers, President, this concern was established in 1904, and it manufactures plumbers earthenware, the output of the plant being equipment for 200,000 closets and tanks yearly. One-half the clay

used comes from England, and the other from North Carolina, the flint, from Maryland, and the spar, from Maine. It employs 250 persons—243 men and 7 girls—of whom 175 are skilled workers.

### **Monongah.**

Monongah, the third largest town in Marion, is located along both banks of West Fork river, at the mouth of Booths creek, and was incorporated as the Town of Monongah, September 12, 1891. In 1900 it had a population of 1,786, and 2,084 in 1910, a gain of 298, or an increase of 14.3 per cent. A large proportion of the population are miners who work in the coal mines in the vicinity. A trolley line, and the Monongahela River Branch of the Baltimore & Ohio Railroad, connect it with Fairmont and Clarksburg.

### **Fairview.**

Fairview, the fourth town of Marion, with a population of 782 in 1910, is located near the head of Pawpaw creek in the northern edge of the county, and is connected with the county seat by a trolley line, extending down the latter stream to Rivesville, and thence up the river to Fairmont. It is surrounded by a great oil and gas field and a fairly rich agricultural community.

### **Barnstown.**

The village of Barnstown, with a population of 655 in 1910, is located at the north edge of Fairmont along Buffalo creek, and was incorporated in 1906. A large percentage of its residents are coal miners. It is connected with Fairmont by trolley line, and the Baltimore & Ohio Railroad.

**Barnesville Manufacturing Company.**—This plant, which was established in 1865, is located in Barnstown and manufactures woolen goods. According to T. J. Titherington, Superintendent, the product consists of flannels, blankets and dress goods, 400 to 450 pounds of wool being used daily. The

equipment consists of a 1 set mill with 14 looms. There are 28 employees—16 men and 12 girls—all being skilled laborers. The monthly payroll is \$1,200.

#### **Farmington (Underwood).**

Farmington, known as Underwood station on the Baltimore & Ohio R. R., with a population of 519 in 1910, is located on Buffalo creek, 10 miles westward from Fairmont, and is connected with the latter place and Mannington by the last railroad mentioned and a trolley line. It was incorporated as the town of Farmington in April, 1901. It has had a rapid growth during the last decade due to the development of the Pittsburgh coal in the immediate vicinity of the town. It is also surrounded by a fairly rich agricultural region and a great natural gas field.

#### **Worthington.**

Worthington, with a population of 292 in 1910, is located 7 miles southwest of Fairmont along the West Fork river, one-fourth mile below the mouth of Tevebaugh creek, and is connected with Fairmont by a trolley line and the Monongahela River Branch of the Baltimore & Ohio Railroad. It is largely a coal mining town, and is also surrounded by a great natural gas field.

#### **Rivesville.**

The town of Rivesville is located on the west bank of the Monongahela river at the mouth of Pawpaw creek, 3½ miles northeastward from Fairmont, and is connected with the latter place by a trolley line and the Pawpaw Branch of the Baltimore & Ohio Railroad, and with Morgantown by the Buckhannon & Northern Branch of the Pittsburgh & Lake Erie R. R. In 1900 its population was 164, and 190 in 1910, a gain of only 26. The town promises to have a rapid growth during the next decade, however, owing to the development of the coal mining industry in the immediate vicinity.

In addition to the above described incorporated cities and towns in Marion, there are a large number of unincorporated villages scattered over the county, a number of which are merely represented by a cross-roads store and post office, while others are largely coal mining towns with several hundred population. These have been arranged below in alphabetical order, and their population indicated for 1912, as given below, except those marked with an asterisk, is as estimated by the postmaster at each place for May, 1912, since the Census Bureau does not determine separately the population of unincorporated town. Those in black face type are largely coal mining villages:

| Towns.                    | Population. | Towns.                          | Population. |
|---------------------------|-------------|---------------------------------|-------------|
|                           | 1912.       |                                 | 1912.       |
| <b>Annabelle</b> .....    | 875         | <b>Hammond</b> .....            | 300         |
| <b>Barrackville</b> ..... | 750         | <b>Hoult</b> .....              | 150         |
| <b>Boothsville</b> .....  | 150         | <b>*Hutchinson</b> .....        | 177         |
| <b>Catawba</b> .....      | 300         | <b>*Klingmont</b> .....         | 50          |
| <b>Chiefton</b> .....     | 319         | <b>Logansport</b> .....         | 38          |
| <b>Colfax</b> .....       | 80          | <b>*Metz</b> .....              | 165         |
| <b>Downs</b> .....        | 250         | <b>*Montana Mines</b> .....     | 435         |
| <b>Everson</b> .....      | 300         | <b>Murray (Scottdale)</b> ..... | 100         |
| <b>Galletin</b> .....     | 37          | <b>*Powells</b> .....           | 69          |
| <b>Glover Gap</b> .....   | 210         | <b>Rymer</b> .....              | 60          |
| <b>Grangeville</b> .....  | —           | <b>Sevenpines</b> .....         | 16          |
| <b>Grant Town</b> .....   | 700         | <b>Watson</b> .....             | 1800        |
| <b>*Graysflat</b> .....   | 96          | <b>Winfield (Canton)</b> .....  | 65          |

### TAYLOR COUNTY.

Taylor county is bounded on the north by Marion and Monongalia; on the east by Preston; on the south by Barbour; and on the west by Harrison. Its area as determined by districts with planimeter from the accurate topographic sheets of the U. S. Geological Survey, is as follows:

| Districts.                    | Sq. Miles.    |
|-------------------------------|---------------|
| Booths Creek .....            | 42.92         |
| Flemington .....              | 18.54         |
| Courthouse .....              | 34.66         |
| Fetterman .....               | 53.36         |
| Knottsville .....             | 27.71         |
| <b>Total for county</b> ..... | <b>177.17</b> |

\*Rand-McNally's Shipper's Guide for W. Va., 1911.

According to Lewis<sup>4</sup>, Taylor county was formed from Harrison, Barbour and Marion counties by an act of the General Assembly of Virginia, January 19, 1844, and named in honor of General Zachary Taylor. The act creating the county, fixed the seat of justice at Williamsport now Pruntytown. The county seat was later transferred to Grafton.

The general surface of the county varies in elevation from 895' A. T., Tygart Valley river level, one-fourth mile southeast of Powells, to 2003' A. T. at the cross-roads near the extreme northern corner of Taylor, a range in elevation of 1108 feet.

**Population.**—According to the census of 1900, the population of Taylor was 14,978, of which 14,553 were white, 423, colored, and 384 foreign born. The census of 1910 gives the total population as 16,554, a gain of 1,576, or an increase of 10.5 per cent. The following table exhibits the changes in population in Taylor county by magisterial districts during the period from 1890 to 1910, as determined by the Census Bureau at Washington, D. C.:

| District—Taylor County.  | Population.  |              |              |
|--|--------------|--------------|--------------|
|  | 1910         | 1900         | 1890         |
| Booths Creek .....   | 1558         | 1589         | 1663         |
| Flemington .....   | 1647         | 1707         | 1119         |
| Courthouse, including Ward 5 of Grafton city...                            | 4402         | 3448         | 2483         |
| Fetterman, including part of Ward 1, Grafton city .....                    | 2982         | 2585         | 2495         |
| Grafton, comprising Wards 2 and 4, and part of Ward 1 of Grafton city..... | 4672         | 4346         | 3159         |
| Knottsville .....  | 1293         | 1303         | 1228         |
| <b>Totals for Taylor county.....</b>                                       | <b>16554</b> | <b>14978</b> | <b>12147</b> |

A glance at the above table will show that the rural districts, represented by Booths Creek, Flemington and Knottsville, have lost in population during the period from 1900 to 1910, while those including parts of the city of Grafton have gained in the same decade. The same conditions have con-

4. History of West Va.; page 684, V. A. Lewis; 1889.



tributed to this decrease in the rural regions of the county as in Monongalia and Marion.

**Products.**—The farm products of Taylor county are corn, wheat, oats, hay, potatoes, garden vegetables, apples, dairy products, beef cattle, sheep and poultry.

The principal mineral and manufactured products are coal, natural gas, lumber, glass ware, wall tile and building stone.

The State Auditor gives the following assessed property valuations for Taylor county for the three years ending with 1912:

|                         | 1910         | 1911         | 1912         |
|-------------------------|--------------|--------------|--------------|
| Real Estate.....        | \$ 9,726,060 | \$ 9,940,810 | \$10,143,810 |
| Personal Property ..... | 2,835,210    | 3,182,920    | 3,130,430    |
| Totals.....             | \$12,561,270 | \$13,123,730 | \$13,274,240 |

A brief description will now be given of the most important towns in the county.

### Grafton.

Grafton is the county seat of Taylor and the largest and most important city in the county. It is located along both banks of Tygart Valley river at the mouth of Threeforks creek, near the central portion of the county. It was incorporated March 15, 1856. During the period from 1900 to 1910 it has enjoyed a rapid growth both in population and industrial activity. In 1900 the population was only 5,650, and 7,563 in 1910, a gain of 1,913, or an increase of 33.8 per cent.

**Industries.**—The principal industries of Grafton are the manufacture of glass ware and wall tile, there being two factories of the former and one of the latter. A short description will now be given of each from data collected by Mr. Reger:

**Tygart Valley Glass Company.**—This plant is located along the main line of the Baltimore & Ohio Railroad on Berkeley run at the southwest edge of Grafton. According to Geo. McCaskey, Gen'l Manager, this factory was established in 1902, and it manufactures glass jars and bottles for

packing of pickles, olives and fruits. Semi-automatic machines are used, and the ware is lime flint glass. The sand comes from Berkeley Springs, Morgan county, the lime, from Tiffin, Ohio (July, 1911) but expects to use lime from Martinsburg, Berkeley county, W. Va., since on test it had given satisfactory results; and the soda ash, from Saltville, Virginia. It employs 165 persons—50 per cent, men, 35 per cent, boys, and 15 per cent, girls—of whom 75 per cent are skilled workers.

**Dominion Window Glass Company.**—This plant is located on the north side of Threeforks creek along the main line of Baltimore & Ohio R. R. in the east end of Grafton. According to W. R. Loar, formerly president of the company, this factory was established in 1904, and is now leased to the W. R. Jones Window Glass Company of Columbus, Ohio. It formerly manufactured hand blown window glass exclusively, having a capacity of 500 boxes daily, but has recently been converted to a machine blowing plant. The sand comes from Crellin, Maryland, and the lime, from Martinsburg. It employs 175 men, 150 of whom are skilled workers.

**Columbia Tile Company.**—This plant is located on the east bank of Tygart Valley river in the northwest edge of Grafton on the site formerly occupied by the Empress Glass Co. According to Wm. H. McGee, Superintendent, it was established in 1911. The product consists of glass tile, having a patent undercut attachment, prism tile, and special lines of pressed glass ware in crystal, opal and other colors. The equipment includes a 10 pot furnace with 2 continuous tanks. Sand from Berkeley Springs is used. 100 men, 95 of whom are skilled, and 50 boys are employed. Mechanical tests of the product will be given in Chapter XIII.

Grafton is also an important railroad center for the Baltimore and Ohio R. R., and many of its residents find employment on the railroad and in the extensive shops of the latter at this place.

### **Pruntytown.**

Pruntytown, located along the Northwestern Virginia

turnpike, 3 miles westward from Grafton, is one of the oldest towns in the county, and was the original county seat of Taylor. Lewis<sup>5</sup> gives the following account of this place:

"Pruntytown—then in Harrison county—was established a town under the name of Williamsport, January 8, 1801, on lands the property of David Prunty, at a place called the 'Cross Roads,' and Peter Plummer, James Cochran, John Asbury, Peter Johnson and Vincent Leek were appointed trustees. By an act of Assembly, January 23, 1845, the name was changed from Williamsport to Pruntytown. The act creating the county fixed the seat of justice at Williamsport."

The town is surrounded by a fairly rich agricultural region, and its population in 1910 was about 300, exclusive of the Reform School.

**West Virginia Reform School.**—The State Reform School for boys is located at Pruntytown. This institution was created for the care, instruction and reformation of boys under 18 years of age. The following interesting account is given of this school on page 171 of Vol. I of the State Board of Control:

"The West Virginia Reform School came into existence by virtue of the act of the Legislature passed in 1889. The Commission to select a site located it at Pruntytown, which was formerly the county seat of Taylor county, four miles west of Grafton, which city is now its post office and railroad station. The old Court House and site were given by Taylor county to the institution, and \$5,000.00 was contributed by the county for the purchase of additional grounds. The entire acreage of the grounds of the institution is about 175. With the exception of the part of it immediately occupied by the buildings and their lawns, it is mainly used for grazing. It is rough hillside land with hard soil; there is not even a sufficient quantity of it suitable for gardening purposes so much needed at the institution.

"The Legislature of 1909 made an appropriation of \$30,000.00 for a farm, the amount to be expended under the direction of the Board of Control.

"To find proper employment for a large portion of boys not adapted to any of the trades, the Superintendent has resorted to leasing lands from adjoining farmers, and now has several tracts under lease. These leases run from one to three years and invariably result in improving the condition of the land leased. If the State had lands of its own upon which this labor and care could be bestowed and followed up from year to year, it could be made very instructive in agricultural pursuits, as well as financially profitable. We call attention to the fact that the farmers of the country with good land use hired labor and run their farms at a profit.

"The State has at this school an average of 267 boys, the great majority of whom are able, and in fact prefer, to work on the farm.

5. History of W. Va., page 684, V. A. Lewis; 1889.

This is the class that more easily submits to and profits by discipline. Experience shows that the very best results in reforming those boys are obtained in that class employed on the farm. If the institution had the proper land all the vegetables needed could be produced with a surplus for other State institutions. Under present conditions, better results are not obtainable."

Recently a new building has been completed for the colored boys of the school. In 1910 the buildings were as follows: Administration Building, for older and larger white boys; Central Dining Hall; Kunst Cottage, for white boys of intermediate size; Davisson Cottage, for the colored boys; Robinson Cottage, for the small white boys; Shop Building containing blacksmith shop, carpenter shop, shoe shop, laundry, power house and tailor shop.

### Webster.

Webster is located on Berkeley run along the main line of the Baltimore & Ohio Railroad, 3.5 miles southwest of Grafton. It is surrounded by a fairly rich agricultural region. In May, 1912, its population was 300, as estimated by the postmaster.

**Webster Woolen Mills Company.**—This plant is located in Webster, but has its main office in Grafton. According to R. E. Senior, Superintendent, this factory was established in 1868, and it manufactures woolen blankets, having a daily capacity of 75 to 100 pairs. The wool used is obtained from eastern markets, and 26 persons are employed, 19 of whom are women, ten of the latter being skilled workers.

In addition to the above described towns in Taylor, the following is a list of other villages in the county of which space does not permit a detailed description. The population is as estimated by the postmaster of each place in May, 1912, since the Census Bureau at Washington, D. C., does not give separately the population of unincorporated towns. Those in black face type are largely coal mining villages:

|                   | Population. |                           | Population. |
|-------------------|-------------|---------------------------|-------------|
|                   | 1912.       |                           | 1912.       |
| Cecil .....       | 35          | Simpson .....             | 500         |
| Flemington .....  | 500         | Thornton .....            | 150         |
| Knottsville ..... | 60          | Tyrconnel (Rosemont)..... | 600         |

# CHAPTER II.

## PHYSIOGRAPHY.

The principles of physiography have been so often discussed in foregoing county reports of the State Survey by the writer<sup>1</sup> that space will not be taken in this volume to repeat the same. The southern terminus of the great northern glacier referred to therein was 60 to 70 miles northwestward from the Monongalia-Marion-Taylor area, but the indirect effects of its flood and water spread over a large portion of the three counties; viz., along the valleys of the Monongahela and Cheat rivers, and their tributaries.

A glance at Map I will show that Monongahela and Cheat rivers have a distinct northward trend. This feature is evidence that they belong to the ancient, preglacial drainage system running northwestward from the site of Pittsburgh via Beaver and Beaver Falls, Pa., into the St. Lawrence drainage basin.

### DESCRIPTION OF THE DRAINAGE BASINS.

The following table exhibits the rate of fall per mile of the principal streams of the three counties; their departure from a straight line course; and the ratio of the total distance between points on same, measured by the meanders of the stream, to the air line distance between the same points:

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1. Marshall-Wetzel-Tyler Report, pp. 32-37, 1909; Wirt-Roane-Calhoun Report, pp. 30-31, 1911; and Doddridge-Harrison Report, pp. 33-35, 1912.

| STREAMS.  | Total Fall. | Total Distance. | Rate of Fall per Mile. | Air Line Distance. | Ratio T. D. to A. L. D. |
|---|-------------|-----------------|------------------------|--------------------|-------------------------|
|   | Feet.       | Miles.          | Feet.                  | Miles.             |                         |
| Monongahela river, Pa.-W. Va. line to West Fork.....        | 73          | 36.8            | 2.0                    | 21.6               | 1.7                     |
| Tygart river, West Fork to Sandy creek .....                | 155         | 28.9            | 5.4                    | 16.9               | 1.7                     |
| Dunkard creek, Wadestown to Shamrock .....                  | 54          | 6.0             | 9.0                    | 4.8                | 1.3                     |
| Dunkard creek, Shamrock to Mt. Morris .....                 | 71          | 20.4            | 3.5                    | 10.7               | 1.9                     |
| Dunkard creek, Mt. Morris to mouth                          | 111         | 12.2            | 9.1                    | 7.6                | 1.6                     |
| Scott run, Cassville to Randall.....                        | 202         | 4.2             | 48.1                   | 3.8                | 1.1                     |
| Indian creek, Hagans to mouth.....                          | 175         | 6.7             | 26.1                   | 5.7                | 1.2                     |
| Paw Paw creek, Fairview to Rivesville .....                 | 140         | 8.9             | 15.7                   | 7.9                | 1.1                     |
| Buffalo creek, Glover Gap to Mannington .....               | 60          | 7.2             | 8.3                    | 6.2                | 1.2                     |
| Buffalo creek, Mannington to mouth                          | 120         | 16.4            | 7.3                    | 11.9               | 1.4                     |
| West Fork river, Bingamon creek to mouth .....              | 18          | 11.4            | 1.6                    | 7.0                | 1.6                     |
| Booths creek, Boothsville to mouth.                         | 72          | 7.5             | 9.6                    | 4.8                | 1.6                     |
| Cheat river, Pt. Marion to Beaver Hole .....                | 88          | 16.8            | 5.2                    | 10.7               | 1.6                     |
| West run, Easton to mouth.....                              | 204         | 4.4             | 46.4                   | 3.7                | 1.2                     |
| Deckers creek, mouth to Dellslow..                          | 191         | 5.9             | 32.4                   | 4.2                | 1.4                     |
| Deckers creek, Dellslow to Falls run top Cascade Falls..... | 650         | 5.6             | 116.1                  | 4.7                | 1.2                     |
| Deckers creek, Cascade Falls to Reedsville .....            | 45          | 5.0             | 9.0                    | 3.4                | 1.5                     |
| Booths creek, Uffington to Clinton Furnace .....            | 250         | 5.3             | 47.2                   | 4.7                | 1.1                     |
| Whiteday creek, Opekiska to Anita                           | 235         | 7.4             | 31.8                   | 5.3                | 1.4                     |
| Whiteday creek, Anita to Marion-Taylor line.....            | 390         | 5.8             | 67.2                   | 4.2                | 1.4                     |
| Prickett creek, mouth to Samaria...                         | 207         | 6.6             | 31.4                   | 5.2                | 1.3                     |
| Threefork creek, Grafton to Hardman .....                   | 121         | 9.8             | 12.3                   | 7.6                | 1.3                     |
| Threefork creek, Hardman to Birds creek .....               | 210         | 7.9             | 26.6                   | 5.8                | 1.4                     |
| Sandy creek, mouth to Little Sandy creek .....              | 284         | 6.6             | 43.0                   | 4.2                | 1.6                     |
| Little Sandy creek, mouth to Fellowsville .....             | 75          | 8.8             | 8.5                    | 4.3                | 2.0                     |

The last column of the above table gives the total distance (T. D.) measured by the meanders of the stream to the air line distance (A. L. D.). It follows that the nearer this ratio approaches unity, the greater the rate of fall.

From the high rate of fall as revealed in the above table,

it is quite evident that none of the streams in the area under discussion has as yet reached base level with the Monongahela river, but the latter stream is fast approaching same with the Ohio at Pittsburgh. The streams possess wide meandering courses along with a rapid rate of fall; hence, it is quite evident that they possess the former character by inheritance.

The following table gives not only the area of the entire drainage basin of the Monongahela river above the mouth of Dunkard creek, three miles north of the W. Va.-Pa. State line, but the area of the drainage basins of several of its most important tributaries located wholly or in part within the Monongalia-Marion-Taylor area:

Table Showing Areas of Drainage Basins.

| Streams.   | Sq. Miles. |
|--|------------|
| Monongahela river above mouth of Dunkard creek.  | 4385.0     |
| Booths creek, Marion county.....                 | 44.9       |
| Booths creek, Monongalia county.....             | 21.7       |
| Buffalo creek .....                              | 125.2      |
| Cheat river, portion included in Monongalia..... | 46.6       |
| Cheat river, total above mouth.....              | 1418.0     |
| Cobun creek .....                                | 11.6       |
| Deckers creek, total above mouth.....            | 63.8       |
| Dents run .....                                  | 14.5       |
| Dunkard creek, portion in West Virginia.....     | 105.4      |
| Dunkard creek, total in both States.....         | 227.4      |
| Indian creek.....                                | 21.5       |
| Pawpaw creek .....                               | 42.5       |
| Pricketts creek .....                            | 24.6       |
| Sandy creek .....                                | 90.0       |
| Scott run .....                                  | 15.0       |
| Threeforks creek .....                           | 103.0      |
| West Fork river, total above mouth.....          | 843.0      |
| Whiteday creek .....                             | 33.4       |

The above areas were determined by Mr. Reger with planimeter from the accurate topographic quadrangles of the U. S. Geological Survey, and from the State Geological map, the latter being accurate to the scale on which it is drawn.

A brief description will now be given of the drainage basins of the largest and most important streams of the three counties; viz., Monongahela, Cheat and West Fork rivers, and Dunkard, Deckers, Buffalo and Threeforks creeks.

### Monongahela River.

The Monongahela river, named from an Indian word signifying sliding banks, is formed by the junction of West Fork and Tygart rivers, one-half mile southwest of Fairmont, from which place it flows northeastward across Marion and Monongalia counties, and thence northward in Pennsylvania to Pittsburgh, where with the Allegheny river it forms the Ohio. The tables given on preceding pages exhibit its rate of fall and the area of its basin above the mouth of Dunkard creek. Its Tygart Valley fork has its head in southern Randolph county at an elevation of 3,500 feet above sea level, but it falls to 858 feet at its mouth near Fairmont, a distance of about 100 miles. The headwaters are mountainous and its valley walls often steep and precipitous, the fall being rapid, causing heavy rains to run off swiftly, producing sudden and intense floods.

The U. S. Geological Survey, in order to determine the surface water supply of the Ohio river basin, established several gaging stations on its many large tributaries in West Virginia. One of these is located on the Tygart river at Fetterman, a suburb of Grafton, Taylor county. The following interesting data obtained at this station, is taken from Water Supply Paper No. 263 of the U. S. Geological Survey, pages 47 and 48, dated 1909:

"This station, which is located at the highway bridge at Fetterman, was established June 3, 1907, to obtain data for use in studying water power, water supply, pollution, flood control, and storage problems.

"Lost Otter creek enters from the west about one-half mile below the station.

"The winters are mild; ice does not form very thick and does not last long. The records are reliable and accurate; the datum of the gage chain attached to the bridge has not been changed.

"Sufficient data have not yet been collected to enable estimates of flow to be made.

#### Discharge measurements of Tygart River at Fetterman, W. Va. in 1909.

| Date.       | Hydrographer.     | Width | Area of Section. | Gage Height. | Discharge. |
|-------------|-------------------|-------|------------------|--------------|------------|
|             |                   | Feet  | Sq. Ft.          | Feet         | Sec.-Ft.   |
| May 19      | A. H. Horton..... | 267   | 1,470            | 4.20         | 722        |
| November 16 | A. H. Horton....  | 268   | 1,580            | 4.56         | 1,080      |
| December 5  | G. L. Parker..... | 269   | 1,410            | 4.11         | 620        |



Daily gage height, in feet, of Tygart River at Fetterman,  
W. Va., for 1909.

(Joseph Gerken, observer).

| Day.    | Jan. | Feb.  | March. | April. | May. | June. | July. | Aug. | Sept. | Oct.  | Nov. | Dec. |
|---------|------|-------|--------|--------|------|-------|-------|------|-------|-------|------|------|
| 1.....  | 3.8  | 4.8   | 5.85   | 5.8    | 7.65 | 4.0   | 4.45  | 5.65 | 3.5   | 3.8   | 4.3  | 4.3  |
| 2.....  | 4.2  | 4.65  | 5.65   | 5.65   | 9.65 | 3.9   | 4.3   | 4.8  | 3.5   | 3.8   | 4.25 | 4.25 |
| 3.....  | 4.35 | 4.55  | 6.15   | 5.8    | 8.7  | 4.05  | 4.15  | 4.65 | 3.55  | 3.75  | 4.15 | 4.15 |
| 4.....  | 4.4  | 4.45  | 8.0    | 5.85   | 6.9  | 4.05  | 4.05  | 4.5  | 3.65  | 3.65  | 4.1  | 4.1  |
| 5.....  | 4.45 | 4.5   | 7.25   | 6.7    | 6.15 | 4.6   | 3.9   | 4.1  | 3.7   | 3.6   | 4.1  | 4.1  |
| 6.....  | 4.4  | 5.05  | 6.5    | 7.0    | 5.75 | 6.05  | 3.75  | 3.9  | 3.55  | 3.5   | 4.05 | 4.05 |
| 7.....  | 4.2  | 5.65  | 6.5    | 6.55   | 5.55 | 5.1   | 3.65  | 3.8  | 3.5   | 3.5   | 4.0  | 4.05 |
| 8.....  | 4.45 | 5.7   | 7.4    | 5.8    | 5.2  | 5.15  | 3.5   | 3.7  | 3.5   | 3.4   | 3.9  | 4.15 |
| 9.....  | 4.6  | 5.65  | 7.3    | 5.5    | 4.85 | 7.15  | 3.45  | 3.65 | 3.5   | 3.4   | 3.9  | 4.1  |
| 10..... | 4.35 | 7.45  | 6.85   | 5.35   | 4.8  | 6.55  | 3.4   | 3.6  | 4.75  | 3.4   | 5.65 | 3.95 |
| 11..... | 4.4  | 8.65  | 6.65   | 5.05   | 4.95 | 8.95  | 3.4   | 3.5  | 5.45  | 3.4   | 8.0  | 3.9  |
| 12..... | 4.6  | 6.8   | 6.1    | 4.85   | 4.9  | 6.8   | 3.45  | 3.5  | 4.8   | 3.8   | 6.2  | 4.1  |
| 13..... | 4.55 | 6.2   | 5.65   | 4.8    | 4.85 | 5.95  | 3.6   | 3.45 | 4.45  | 4.4   | 5.5  | 4.2  |
| 14..... | 4.5  | 5.95  | 5.6    | 9.3    | 4.8  | 5.4   | 3.55  | 3.35 | 4.1   | 4.35  | 5.15 | 5.15 |
| 15..... | 7.7  | 5.95  | 5.8    | 11.5   | 4.7  | 5.75  | 3.45  | 3.35 | 3.95  | 4.3   | 4.9  | 5.85 |
| 16..... | 9.6  | 9.3   | 5.7    | 7.8    | 4.55 | 5.8   | 3.55  | 3.6  | 3.85  | 4.1   | 4.65 | 5.75 |
| 17..... | 8.9  | 8.7   | 5.45   | 6.45   | 4.45 | 5.25  | 3.7   | 4.3  | 6.55  | 3.9   | 4.5  | 5.15 |
| 18..... | 7.6  | 7.35  | 5.25   | 5.65   | 4.2  | 9.85  | 3.65  | 5.05 | 4.75  | 4.15  | 4.4  | 4.85 |
| 19..... | 5.9  | 6.6   | 4.95   | 5.4    | 3.95 | 7.3   | 3.6   | 4.7  | 4.5   | 4.15  | 4.4  | 4.6  |
| 20..... | 5.65 | 6.2   | 4.9    | 6.1    | 4.0  | 5.85  | 3.45  | 4.3  | 4.25  | 4.85  | 4.25 | 4.45 |
| 21..... | 5.45 | 5.95  | 4.85   | 8.2    | 4.05 | 5.2   | 3.4   | 4.2  | 3.9   | 5.1   | 4.15 | 4.25 |
| 22..... | 5.3  | 6.45  | 4.7    | 11.45  | 4.15 | 4.65  | 3.35  | 4.6  | 3.8   | 4.95  | 4.05 | 4.2  |
| 23..... | 5.15 | 6.55  | 4.65   | 11.05  | 4.2  | 4.5   | 3.3   | 4.3  | 3.7   | 5.8   | 4.0  | 4.2  |
| 24..... | 5.3  | 8.5   | 4.45   | 9.25   | 4.2  | 4.35  | 3.3   | 4.1  | 3.9   | 12.75 | 4.3  | 4.15 |
| 25..... | 5.35 | 10.05 | 4.55   | 8.3    | 4.15 | 4.25  | 3.55  | 3.9  | 4.7   | 11.2  | 4.7  | 4.1  |
| 26..... | 4.8  | 7.75  | 4.75   | 7.6    | 4.0  | 4.15  | 3.9   | 3.75 | 4.6   | 7.85  | 4.7  | .... |
| 27..... | 4.65 | 6.7   | 5.6    | 6.4    | 4.1  | 4.1   | 4.15  | 3.65 | 4.2   | 6.3   | 4.55 | .... |
| 28..... | 4.5  | 6.15  | 6.2    | 6.05   | 4.5  | 4.9   | 3.9   | 3.5  | 4.1   | 5.3   | 4.4  | .... |
| 29..... | 4.55 | ....  | 6.6    | 5.75   | 4.35 | 5.1   | 3.7   | 4.65 | 3.95  | 4.9   | 4.35 | .... |
| 30..... | 4.65 | ....  | 6.55   | 6.05   | 4.15 | 4.6   | 4.15  | 4.25 | 3.9   | 4.65  | 4.3  | .... |
| 31..... | 4.8  | ....  | 6.4    | ....   | 4.05 | ....  | 6.2   | 3.55 | ....  | 4.55  | .... | 3.5  |

Note.—Ice conditions December 15 to 31. Frozen over December 22. Thickness of ice December 31, 0.3 foot.

A similar station was established by the U. S. Geological Survey at Enterprise, Harrison county, on the West Fork branch of the Monongahela, and the data there obtained, as taken from pages 49 and 50 of Paper No. 263 above, was pub-





PLATE. IX.—Topography of the Pottsville Series along Cheat River, looking south from Mont Chateau, Monongalia County.



lished on pages 37 and 38 of the Doddridge-Harrison report of the State Geological Survey. As mentioned in the Water Supply Paper above, the gages at neither of these stations have extended over a sufficient period of time to be reliable.

In the three counties under discussion, there occur several old abandoned erosion levels or terraces along the valley walls of the Monongahela river and its two large tributaries—Tygart and West Fork rivers. What appears to be an old abandoned channel of the Monongahela, occurs three-fourths mile eastward from Fairmont. The present channel of Hickman run, where the latter has a northeast-southwest direction, occupies this old river bed which can easily be followed in its crescent shape to an intersection with the present river channel, one-fourth mile below the mouth of Buffalo creek.

On the point between the two rivers, immediately southward from Watson, large deposits of quicksand have been deposited at the 950 to 1050' A. T. level as the channels of these streams swerved back and forth during the glacial period. The several terraces of the Monongahela will be treated more in detail under the discussion of the topography of the land area in this chapter.

**Cheat River.**—Cheat river, the largest West Virginia tributary of the Monongahela, empties into the latter at Point Marion, Pa., 1.5 miles northward from the W. Va.-Pa. State line. It has its head in the northwestern border of Pocahontas county at an elevation of 4000 feet above sea level, and falls to 780 feet at its mouth. From Parsons to Rowlesburg the river falls from 1630 to about 1360' A. T., in a distance of  $33\frac{1}{2}$  miles, or at the rate of 8.1 feet to the mile. From Rowlesburg to the State line, it falls from about 1360 feet to 787' A. T., in a distance of 40 miles, or at the rate of 14.3 feet to the mile. The total area of its drainage basin, as given in the table on a preceding page, is slightly over 1400 square miles, and the mean annual rainfall<sup>2</sup> therein is from 45 to 50 inches; hence, the great possibilities for power development along this stream.

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2. Water Supply Paper No. 263, page 46, U. S. G. Survey; 1909.

As evidence that this great source of power is not being overlooked by private capital, its development has already been started on an immense scale by the W. Va. Development Company of Pittsburgh, Pa. This company plans to build a series of great dams, 50 to 80 feet in height, the first of which is to be located in the northern edge of Monongalia county, about 500 feet southeastward from the river's intersection with the State line. These great impounding reservoirs will virtually control the flood waters of this river, and tend in no small measure to reduce the damages from floods in the Pittsburgh district.

A gaging station, similar to those mentioned on preceding pages for Fetterman and Enterprise, was established by the U. S. Geological Survey on Cheat river near the Ice's Ferry bridge, about 7 miles above the State line. The following interesting facts, obtained at this station, were taken from Water Supply Paper No. 263 of the U. S. G. Survey, pages 51-62.

"This station, which was maintained from July 8 to December 30, 1899, July 1 to December 29, 1900, and August 21, 1902, to December 31, 1905, was reestablished November 18, 1908, by F. W. Scheidenhelm, through whose courtesy the 1908 and 1909 discharge measurements and gage heights have been furnished to the United States Geological Survey for publication.

"The data are of value for determining the quantity of water available for power and storage and the effect of Cheat river run-off on floods and pollution of Monongahela river.

"The staff gage for this station was originally located about 100 feet above the present location of Ice's ferry bridge at Uneva, W. Va., about 6 miles northeast of Morgantown and 10 miles above the mouth of Cheat river. The 1899 measurement was made from a cable which was located at the gage. During 1900 the cable was moved downstream about 1 mile and all subsequent measurements were made at the new cable location except those stated to have been made at wading sections or at Ice's ferry bridge. The first four measurements made during 1899 to 1901 were referred to the staff gage immediately above the present location of Ice's ferry bridge.

"On August 20, 1902, a new inclined and vertical staff gage was installed about 275 feet below the new cable section. The readings were made on the inclined section below 6.5 feet. The new gage was set to read the same as the original gage at 1.8 feet. On September 28, 1904, the inclined portion of this staff gage was found to be 0.35 foot too high and the vertical section 0.15 foot too high. Both sections were accordingly lowered. On September 28, 1904, a chain gage was established on Ice's ferry bridge to read the same as the second staff gage at 1.85 feet. Both gages were maintained from September 28, 1904, to December 31, 1905. The staff gage was maintained from November 18, 1908, to May 8, 1909, and the chain gage has been maintained from January 21, 1909, to date. From these simultaneous gage readings the following gage relation has been determined:





## Relation of gages on Cheat River.

| Chain gage. | Staff gage. | Chain gage. | Staff gage. |
|-------------|-------------|-------------|-------------|
| Feet        | Feet        | Feet        | Feet        |
| 1.5         | 1.52        | 6.5         | 7.69        |
| 2.0         | 2.00        | 7.0         | 8.28        |
| 2.5         | 2.52        | 7.5         | 8.87        |
| 3.0         | 3.11        | 8.0         | 9.43        |
| 3.5         | 3.78        | 8.5         | 9.98        |
| 4.0         | 4.46        | 9.0         | 10.53       |
| 4.5         | 5.15        | 9.5         | 11.06       |
| 5.0         | 5.82        | 10.0        | 11.59       |
| 5.5         | 6.47        | 10.5        | 12.11       |
| 6.0         | 7.09        | 11.0        | 12.65       |

"All discharge measurements and gage heights from 1902 to 1909, as published below, are referred to the second staff gage. All gage heights from 1902 to September 28, 1904, have been reduced to the gage zero established September 28, 1904. Gage heights previously published for 1899-1900 are referred to the original staff gage and are correct as originally published.

"The original staff gage and the chain gage are located in a deep pool, with large islands about one-fourth mile above and below the station. The second staff gage is also located in a deep pool of somewhat smaller dimensions than at the original location. It is situated nearly one-fourth mile below a large island and a short distance above a small island. Both pools are controlled by permanent rock reefs. Water was diverted around the lower gage for milling prior to 1908. The quantity thus diverted was relatively small (see table of discharge measurements) except at low stages, and has been disregarded in the following computations of discharge, but should, however, be taken into consideration in making use of the tables to determine the run-off in the Cheat river drainage basin. No important tributaries enter Cheat river near the gaging station.

"Large ice jams sometimes occur at this station. In January, 1904, the ice piled up from 8 to 10 feet above normal low-water stage, thus greatly affecting the relation of gage height to discharge. For the occurrence of other periods of ice effect, as determined by observer's records and climatological reports, see gage-height table footnotes.

"The discharge for these periods has been estimated, and it is assumed that the open-channel rating applies for all other winter periods.

"The curves developed are very satisfactory and the daily and monthly discharge values given in the following table are considered very good, with the possible exception of those for 1902-3, for which period there is some doubt about the elevation of the inclined gage. However, as the two measurements made during 1902-3 plot practically on the 1904-1909 discharge curve, when their gage heights are increased 0.35 foot, it is evident either that the inclined gage was set incorrectly at the time of its installation by the amount of the error in the gage (0.35 foot) discovered during 1904 or else that conditions of flow were different in these two years from what they have been since.



In either event the correctness of all gage heights for 1902-3 in accordance with the discrepancies found September 28, 1904, will yield essentially correct results for these years, and these corrections have accordingly been made.

"The discharge for low stages during 1899-1900 is also somewhat open to question. It has been impossible as yet to determine the period when Ice's ferry bridge was erected. The somewhat conflicting statements obtained seem to indicate that the bridge was built during 1900 or 1901. In any event it is probable that both the measurements made during 1901 were affected by the backwater from the bridge. This backwater effect is, however, very slight at low stages, owing to the deep, wide pool in which the gage is located. The two rating curves probably converge to a common curve at some point above the stage of zero flow. Hence at low stages the 1899-1900 discharges may be too high.

**Discharge measurements of Cheat River near Morgantown,  
W. Va., in 1899-1905, 1908, 1909.**

| Date.     | Hydrographer.              | Width. | Area of section. | Gage height. | Discharge. |
|-----------|----------------------------|--------|------------------|--------------|------------|
| 1899      |                            | Feet.  | Sq. ft.          | Feet.        | Sec.-ft.   |
| July 8a   | E. G. Paul.....            | 367    | 2,160            | 2.60         | 1,150      |
| 1900      |                            |        |                  |              |            |
| June 25b  | do.....                    | 292    | 1,240            | 2.80         | 1,400      |
| 1901      |                            |        |                  |              |            |
| July 26d  | do.....                    | 282    | 1,060            | 2.30         | 710        |
| Nov. 5e   | do.....                    | 139    | 167              | 1.45         | 222        |
| 1902      |                            |        |                  |              |            |
| Aug. 20b  | do.....                    | 275    | 940              | 2.10         | 299        |
| 1903      |                            |        |                  |              |            |
| Sept. 1b  | do.....                    | 283    | 1,090            | 2.65         | 1,672      |
| 1904      |                            |        |                  |              |            |
| July 6b   | Hoyt and Hall.....         | 300    | 1,230            | 2.95         | 773        |
| Sept. 16g | R. J. Taylor.....          | 275    | 887              | 2.00         | 136        |
| 1905      |                            |        |                  |              |            |
| Mar. 17h  | Grover and Morse.....      | 388    | 2,750            | 5.56         | 5,720      |
| Do b      | do.....                    | 320    | 1,950            | 5.62         | 5,940      |
| 1908      |                            |        |                  |              |            |
| Nov. 18i  | Scheidenhelm and Custer... | 83     | 73.7             | 1.61         | 131        |
| Dec. 9j   | L. B. Custer.....          | 171    | 141              | 1.86         | 223        |
| 1909      |                            |        |                  |              |            |
| Jan. 21k  | Horton and Scheidenhelm... | 385    | 2,450            | 4.16         | 2,410      |
| Apr. 28h  | Scheidenhelm and Hammel..  | 395    | 2,900            | 5.16         | 4,520      |
| June 6h   | do.....                    | 412    | 3,380            | 7.26         | 10,600     |
| June 7h   | V. F. Hammel.....          | 397    | 2,880            | 5.62         | 6,140      |
| July 12l  | do.....                    | 106    | 132              | 2.34         | 358        |
| Aug. 19h  | Scheidenhelm and Hammel.   | 386    | 2,460            | 4.06         | 2,180      |
| Do h      | do.....                    | 385    | 2,390            | 3.99         | 1,950      |

a Measurement made at original cable section above the present Ice's ferry bridge.

b Measurement made at second cable section about 1 mile below the bridge.

c Mill-race discharge of 25 second-feet included in total discharge of the river.

d Measurement at second cable section about 1 mile below the bridge. Somewhat affected by new Ice's ferry bridge which was erected below the original gage during 1900 to 1901. Mill-race discharge of 6 second-feet included in total discharge of the river.

e Measurement made at wading section, 700 feet above the second cable location. Somewhat affected by new Ice's ferry bridge, which was erected just below the original gage during 1900 to 1901.

f Mill-race discharge of 10 second-feet not included in value of discharge given.

g Measurement at second cable section. Considered inaccurate on account of low velocity, and not used in developing the discharge curve.

h Measurement made at Ice's ferry bridge. Gage height was read on the chain gage and reduced to the corresponding reading on the staff gage.

i Measurement at wading section, three-eighths mile above the bridge.

j Measurement at wading section, one-fourth mile below the cable.

k Measurement at Ice's ferry bridge.

l Measurement at wading section, one-half mile above the bridge. Gage height read on chain gage and reduced to corresponding reading on the staff gage.

NOTE.—Gage heights 1899-1901 refer to original staff gage established July 8, 1899, above the present Ice's ferry bridge. Gage heights 1902-1905 and 1908-9 refer to the staff gage established August 21, 1902, about 1 mile below the bridge, and have been reduced to the present datum. Gage heights of measurements read on the chain gage have been reduced to the corresponding reading on the staff gage. All other gage heights were read directly on the staff gage.

Daily gage height, in feet, of Cheat River near Morgantown, W. Va., for 1899, 1900, 1902 to 1905, 1908, and 1909.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Day  | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|------|-------|------|-------|------|------|------|------|-------|------|-------|------|------|------|
| 1899 |       |      |       |      |      |      | 1899 |       |      |       |      |      |      |
| 1    | ....  | 3.0  | 2.2   | 2.0  | 3.7  | 2.9  | 16   | 2.8   | 2.3  | 2.8   | 1.7  | 2.5  | 3.8  |
| 2    | ....  | 2.8  | 2.0   | 2.0  | 4.0  | 2.8  | 17   | 3.5   | 2.4  | 2.7   | 1.8  | 2.4  | 3.4  |
| 3    | ....  | 2.7  | 2.3   | 1.9  | 3.8  | 2.7  | 18   | 3.4   | 2.3  | 2.3   | 1.8  | 2.4  | 3.2  |
| 4    | ....  | 2.5  | 2.2   | 1.9  | 3.5  | 2.7  | 19   | 3.0   | 2.2  | 2.2   | 1.7  | 2.5  | 3.0  |
| 5    | ....  | 3.4  | 2.2   | 1.9  | 3.3  | 2.6  | 20   | 2.8   | 2.1  | 2.0   | 1.7  | 3.4  | 4.8  |
| 6    | ....  | 3.3  | 2.2   | 1.9  | 3.1  | 2.6  | 21   | 2.4   | 2.0  | 1.9   | 1.6  | 3.4  | 4.4  |
| 7    | ....  | 3.0  | 2.1   | 1.8  | 2.1  | 2.5  | 22   | 2.4   | 2.0  | 1.9   | 1.6  | 3.2  | 4.1  |
| 8    | 2.6   | 2.8  | 2.0   | 1.8  | 2.1  | 2.5  | 23   | 2.4   | 1.9  | 2.3   | 1.6  | 3.0  | 3.9  |
| 9    | 3.0   | 2.7  | 2.0   | 1.8  | 2.8  | 2.5  | 24   | 2.3   | 1.9  | 2.2   | 1.6  | 3.0  | 5.2  |
| 10   | 2.8   | 2.6  | 2.2   | 1.7  | 2.7  | 2.5  | 25   | 2.5   | 1.8  | 2.2   | 1.6  | 3.9  | 4.4  |

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec.  | Day. | July. | Aug. | Sept. | Oct. | Nov.  | Dec.  |
|------|-------|------|-------|------|------|-------|------|-------|------|-------|------|-------|-------|
| 1899 |       |      |       |      |      |       | 1899 |       |      |       |      |       |       |
| 11   | 2.7   | 2.5  | 4.1   | 1.7  | 2.6  | 2.7   | 26   | 2.7   | 1.8  | 2.1   | 1.7  | 3.7   | 3.6   |
| 12   | 2.5   | 2.4  | 3.8   | 1.7  | 2.9  | 5.5   | 27   | 2.8   | 1.8  | 2.3   | 1.7  | 3.5   | 3.2   |
| 13   | 2.4   | 2.3  | 3.5   | 1.7  | 2.7  | 6.4   | 28   | 2.6   | 2.5  | 2.4   | 1.7  | 3.3   | 2.9   |
| 14   | 2.5   | 2.2  | 3.2   | 1.7  | 2.6  | 4.8   | 29   | 2.5   | 2.4  | 2.3   | 1.7  | 3.1   | 2.7   |
| 15   | 2.8   | 2.2  | 3.0   | 1.7  | 2.6  | 4.2   | 30   | 3.5   | 2.3  | 2.2   | 1.7  | 3.1   | 2.6   |
|      |       |      |       |      |      |       | 31   | 3.6   | 2.3  | ..... | 1.7  | ..... | ..... |
| 1900 |       |      |       |      |      |       | 1900 |       |      |       |      |       |       |
| 1    | 3.2   | 3.2  | 2.3   | 2.1  | 1.6  | ..... | 16   | 2.6   | 1.6  | 1.4   | 1.4  | 2.2   | 3.0   |
| 2    | 2.8   | 3.1  | 2.1   | 2.0  | 1.6  | 4.0   | 17   | 2.8   | 1.6  | 1.4   | 1.4  | 2.2   | 2.9   |
| 3    | 2.7   | 2.9  | 2.0   | 1.9  | 1.7  | 4.0   | 18   | 2.9   | 1.5  | 1.4   | 1.4  | 2.1   | 2.8   |
| 4    | 2.6   | 2.7  | 1.9   | 1.8  | 1.7  | 4.3   | 19   | 2.9   | 1.5  | 1.4   | 1.5  | 2.2   | 2.8   |
| 5    | 2.6   | 2.6  | 1.6   | 1.7  | 1.6  | 7.0   | 20   | 3.0   | 1.6  | 1.4   | 1.4  | 3.0   | 2.7   |
| 6    | 2.4   | 2.4  | 1.5   | 1.6  | 2.0  | 7.0   | 21   | 3.0   | 2.0  | 1.3   | 1.3  | 3.3   | 2.7   |
| 7    | 2.3   | 2.4  | 1.4   | 1.5  | 2.3  | 6.0   | 22   | 3.0   | 1.9  | 1.5   | 1.3  | 3.5   | 2.6   |
| 8    | 3.0   | 2.3  | 1.4   | 1.6  | 2.5  | 5.0   | 23   | 2.9   | 1.8  | 1.5   | 1.3  | 3.8   | 3.0   |
| 9    | 2.9   | 2.0  | 1.4   | 1.7  | 2.4  | 4.4   | 24   | 3.5   | 1.8  | 1.4   | 2.3  | 4.0   | 3.2   |
| 10   | 2.9   | 2.0  | 1.4   | 1.7  | 2.2  | 4.7   | 25   | 4.8   | 1.8  | 1.4   | 2.3  | ..... | 3.3   |
| 11   | 2.8   | 2.0  | 1.4   | 1.7  | 2.0  | 3.4   | 26   | 5.1   | 1.8  | 1.5   | 2.2  | ..... | 3.3   |
| 12   | 2.7   | 1.8  | 1.4   | 1.7  | 1.9  | 3.4   | 27   | 5.2   | 1.7  | 1.3   | 2.1  | ..... | 3.2   |
| 13   | 2.6   | 1.7  | 1.3   | 1.6  | 1.9  | 3.2   | 28   | 4.9   | 1.7  | 1.3   | 2.0  | ..... | 3.1   |
| 14   | 2.5   | 1.7  | 1.3   | 1.5  | 1.9  | 3.0   | 29   | 3.7   | 2.0  | 1.4   | 1.8  | ..... | 3.1   |
| 15   | 2.6   | 1.7  | 1.3   | 1.5  | 2.0  | 3.0   | 30   | 3.4   | 2.3  | 1.4   | 1.7  | ..... | ..... |
|      |       |      |       |      |      |       | 31   | 3.2   | 2.3  | ..... | 1.6  | ..... | ..... |

| Day. | Aug.  | Sept. | Oct. | Nov. | Dec.  | Day. | Aug.  | Sept. | Oct. | Nov.  | Dec. |
|------|-------|-------|------|------|-------|------|-------|-------|------|-------|------|
| 1902 |       |       |      |      |       | 1902 |       |       |      |       |      |
| 1    | ..... | 2.05  | 3.15 | 2.85 | 5.0   | 16   | ..... | 1.8   | 3.65 | 2.55  | 10.6 |
| 2    | ..... | 2.05  | 5.15 | 2.55 | 4.85  | 17   | ..... | 1.75  | 3.35 | 2.55  | 9.35 |
| 3    | ..... | 2.05  | 4.0  | 2.55 | 6.4   | 18   | ..... | 1.75  | 3.15 | 2.55  | 7.65 |
| 4    | ..... | 2.15  | 3.75 | 2.55 | 6.65  | 19   | ..... | 1.85  | 3.0  | 2.35  | 6.0  |
| 5    | ..... | 2.0   | 3.75 | 2.4  | 5.7   | 20   | ..... | 1.75  | 2.8  | 2.35  | 4.3  |
| 6    | ..... | 2.65  | 3.8  | 2.25 | 4.95  | 21   | 2.15  | 1.75  | 2.8  | 2.5   | 4.75 |
| 7    | ..... | 2.35  | 3.4  | 2.5  | 4.5   | 22   | 2.25  | 1.65  | 2.7  | 2.75  | 5.55 |
| 8    | ..... | 2.2   | 3.2  | 2.55 | 4.45  | 23   | 2.95  | 1.65  | 2.55 | 2.7   | 5.85 |
| 9    | ..... | 2.05  | 2.95 | 2.75 | 4.3   | 24   | 3.05  | 1.65  | 2.55 | 3.1   | 5.15 |
| 10   | ..... | 2.05  | 2.7  | 2.6  | 3.9   | 25   | 2.65  | 1.65  | 2.55 | 4.7   | 4.65 |
| 11   | ..... | 2.05  | 2.55 | 2.55 | 5.95  | 26   | 2.4   | 1.8   | 2.45 | 8.15  | 4.3  |
| 12   | ..... | 1.95  | 5.8  | 2.55 | 11.05 | 27   | 2.25  | 2.05  | 2.55 | 6.95  | 3.8  |
| 13   | ..... | 1.95  | 5.3  | 2.55 | 10.65 | 28   | 2.15  | 1.95  | 3.1  | 5.7   | 3.55 |
| 14   | ..... | 1.85  | 4.75 | 2.6  | 9.1   | 29   | 2.05  | 2.35  | 2.95 | 4.9   | 3.7  |
| 15   | ..... | 1.85  | 4.1  | 2.55 | 6.85  | 30   | 2.05  | 2.4   | 2.95 | 4.4   | 5.1  |
|      |       |       |      |      |       | 31   | 2.05  | ..... | 2.85 | ..... | 4.9  |

Note.—The temperature was low December 25 to 31, 1899, but the discharge was probably not materially affected by ice conditions.

Note.—The discharge was probably unaffected by ice conditions during December, 1900.

Note.—Discharge unaffected by ice conditions December, 1902.

## Daily gage height, in feet, of Cheat River, near Morgantown, W. Va., for 1899, 1900, 1902 to 1905, 1908, and 1909—Continued.

| Day.    | Jan.  | Feb.  | March. | April. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---------|-------|-------|--------|--------|------|-------|-------|------|-------|------|------|------|
| 1903.   |       |       |        |        |      |       |       |      |       |      |      |      |
| 1.....  | 4.3   | 6.5   | 10.7   | 4.05   | 3.5  | 3.6   | 6.0   | 2.6  | 2.6   | 1.75 | 1.85 | 2.2  |
| 2.....  | 4.1   | 6.75  | 7.1    | 4.15   | 3.4  | 3.3   | 5.6   | 3.15 | 2.55  | 1.75 | 1.85 | 2.2  |
| 3.....  | 10.25 | 7.5   | 5.95   | 4.15   | 3.35 | 3.35  | 4.45  | 3.05 | 2.5   | 1.75 | 1.85 | 2.25 |
| 4.....  | 9.05  | 9.35  | 5.25   | 4.4    | 3.65 | 3.05  | 4.0   | 2.85 | 2.35  | 1.75 | 1.85 | 2.25 |
| 5.....  | 6.95  | 8.95  | 4.9    | 5.7    | 3.6  | 2.85  | 4.2   | 2.7  | 2.15  | 1.9  | 1.9  | 2.15 |
| 6.....  | 5.85  | 6.6   | 4.85   | 4.95   | 3.4  | 2.85  | 4.95  | 2.45 | 2.15  | 2.2  | 2.1  | 2.15 |
| 7.....  | 5.15  | 5.7   | 5.1    | 4.8    | 3.25 | 3.85  | 4.3   | 2.65 | 2.05  | 2.2  | 2.25 | 2.15 |
| 8.....  | 4.7   | 5.15  | 7.25   | 6.9    | 3.1  | 6.0   | 4.05  | 2.45 | 2.05  | 2.05 | 2.5  | 2.1  |
| 9.....  | 3.95  | 4.95  | 8.4    | 8.5    | 3.05 | 5.0   | 3.55  | 2.45 | 2.05  | 3.4  | 2.4  | 2.05 |
| 10..... | 3.65  | 4.45  | 6.9    | 6.7    | 2.9  | 4.3   | 3.3   | 2.35 | 2.15  | 3.45 | 2.25 | 2.1  |
| 11..... | 3.75  | 4.3   | 6.05   | 5.8    | 2.85 | 3.95  | 3.8   | 2.3  | 2.15  | 3.0  | 2.2  | 2.15 |
| 12..... | 6.2   | 5.4   | 5.65   | 5.4    | 2.85 | 5.15  | 4.3   | 2.25 | 2.1   | 2.6  | 2.15 | 2.0  |
| 13..... | 5.25  | 6.1   | 5.3    | 5.3    | 2.7  | 7.05  | 5.1   | 2.25 | 2.0   | 2.45 | 2.1  | 2.15 |
| 14..... | 5.7   | 5.3   | 4.95   | 5.1    | 2.65 | 7.15  | 5.65  | 2.1  | 1.95  | 2.6  | 2.05 | 2.6  |
| 15..... | 5.95  | 6.0   | 4.4    | 4.95   | 2.6  | 7.35  | 4.75  | 2.1  | 1.85  | 2.45 | 2.05 | 2.6  |
| 16..... | 4.45  | 11.25 | 4.25   | 5.85   | 2.8  | 6.2   | 4.05  | 2.05 | 1.85  | 2.35 | 2.05 | 2.75 |
| 17..... | 4.2   | 8.4   | 4.15   | 5.85   | 2.7  | 5.1   | 3.6   | 2.05 | 1.85  | 2.25 | 2.55 | 2.55 |
| 18..... | 3.9   | 6.45  | 3.95   | 5.85   | 2.6  | 4.45  | 3.6   | 2.05 | 1.85  | 2.25 | 5.6  | 2.55 |
| 19..... | 3.55  | 5.2   | 3.75   | 5.3    | 2.55 | 4.05  | 3.55  | 2.15 | 2.35  | 2.4  | 4.5  | 2.35 |
| 20..... | 3.35  | 5.1   | 3.6    | 4.75   | 2.45 | 3.85  | 4.4   | 2.2  | 2.9   | 2.7  | 3.6  | 2.45 |
| 21..... | 3.75  | 4.5   | 4.7    | 4.4    | 2.4  | 5.2   | 4.65  | 2.15 | 2.4   | 2.55 | 3.1  | 4.35 |
| 22..... | 4.15  | 4.35  | 5.55   | 4.25   | 2.3  | 4.9   | 3.8   | 2.85 | 2.2   | 2.45 | 2.9  | 4.25 |
| 23..... | 4.0   | 3.95  | 8.1    | 4.0    | 2.65 | 5.0   | 3.4   | 2.5  | 2.05  | 2.35 | 2.85 | 3.8  |
| 24..... | 3.75  | 4.15  | 9.65   | 3.8    | 3.85 | 5.65  | 3.1   | 2.3  | 2.0   | 2.25 | 2.75 | 3.35 |
| 25..... | 3.65  | 4.2   | 6.75   | 3.9    | 4.6  | 4.75  | 2.85  | 2.1  | 1.95  | 2.15 | 2.6  | 4.8  |
| 26..... | 3.5   | 4.05  | 5.7    | 3.9    | 5.65 | 4.05  | 2.65  | 2.05 | 1.85  | 2.0  | 2.6  | 5.7  |
| 27..... | 3.55  | 4.3   | 4.95   | 4.4    | 6.65 | 3.65  | 2.55  | 2.05 | 1.85  | 2.05 | 2.4  | 4.4  |
| 28..... | 6.4   | 11.45 | 4.55   | 4.15   | 5.4  | 4.1   | 2.35  | 2.1  | 1.85  | 2.05 | 2.4  | 3.85 |
| 29..... | 8.65  | ....  | 4.15   | 3.9    | 4.65 | 8.85  | 2.45  | 2.1  | 1.85  | 2.05 | 2.25 | 3.5  |
| 30..... | 8.9   | ....  | 4.05   | 3.65   | 4.2  | 7.7   | 2.4   | 2.1  | 1.75  | 1.95 | 2.25 | 3.5  |
| 31..... | 8.3   | ....  | 4.05   | ....   | 3.95 | ....  | 2.35  | 2.6  | ....  | 1.95 | .... | 3.2  |
| 1904.   |       |       |        |        |      |       |       |      |       |      |      |      |
| 1.....  | 3.3   | 3.6   | 6.55   | 6.6    | 6.25 | 3.4   | 3.6   | 2.15 | 1.8   | 1.6  | 2.0  | 2.0  |
| 2.....  | 3.25  | 3.0   | 6.8    | 6.7    | 5.85 | 3.45  | 4.0   | 2.25 | 1.85  | 1.85 | 2.0  | 2.05 |
| 3.....  | 8.75  | 3.25  | 7.2    | 5.95   | 4.95 | 3.5   | 3.65  | 2.15 | 1.85  | 1.9  | 1.9  | 2.2  |
| 4.....  | 11.15 | 3.15  | 8.35   | 5.1    | 5.0  | 3.9   | 3.35  | 2.35 | 1.85  | 1.9  | 1.9  | 2.1  |
| 5.....  | 11.15 | 3.0   | 6.55   | 4.55   | 4.55 | 3.85  | 3.0   | 2.55 | 1.85  | 1.9  | 1.9  | 2.1  |
| 6.....  | 11.15 | 3.0   | 5.5    | 4.3    | 4.2  | 4.8   | 3.0   | 2.35 | 1.8   | 1.85 | 1.9  | 2.6  |
| 7.....  | 11.15 | 4.9   | 6.1    | 4.15   | 3.95 | 4.3   | 3.65  | 2.25 | 1.75  | 1.85 | 1.82 | 2.5  |
| 8.....  | 11.15 | 8.65  | 7.45   | 4.05   | 3.75 | 4.1   | 3.5   | 2.3  | 1.75  | 1.9  | 1.8  | 2.5  |
| 9.....  | 11.15 | 6.45  | 6.7    | 4.05   | 3.55 | 3.85  | 3.4   | 2.15 | 1.75  | 1.8  | 1.8  | 2.5  |
| 10..... | 11.15 | 5.35  | 5.7    | 4.15   | 3.75 | 3.7   | 3.3   | 2.05 | 1.75  | 1.9  | 1.8  | 2.4  |

| Day.    | Jan.  | Feb.  | March. | April. | May. | June. | July. | Aug. | Sept. | Oct. | Nov.  | Dec. |
|---------|-------|-------|--------|--------|------|-------|-------|------|-------|------|-------|------|
| 11..... | 11.15 | 4.65  | 5.15   | 4.0    | 3.75 | 3.5   | 3.55  | 2.05 | 1.75  | 1.95 | 1.8   | 2.35 |
| 12..... | 11.15 | 4.0   | 5.05   | 3.85   | 3.45 | 3.3   | 3.5   | 2.0  | 1.75  | 2.0  | 1.8   | 2.2  |
| 13..... | 11.15 | 3.6   | 4.9    | 3.8    | 3.3  | 3.1   | 3.35  | 2.05 | 1.75  | 2.05 | 1.8   | 2.15 |
| 14..... | 11.15 | 3.65  | 4.55   | 3.85   | 3.25 | 2.9   | 3.05  | 2.05 | 1.85  | 2.75 | 1.8   | 2.05 |
| 15..... | 11.15 | 3.8   | 5.15   | 3.7    | 3.4  | 2.85  | 2.8   | 2.05 | 1.85  | 2.3  | 1.9   | 2.15 |
| 16..... | 11.15 | 3.4   | 4.95   | 3.95   | 3.7  | 2.85  | 2.7   | 1.95 | 2.08  | 2.2  | 1.95  | 2.15 |
| 17..... | 11.15 | 2.95  | 4.4    | 5.05   | 3.65 | 2.75  | 2.55  | 1.95 | 1.95  | 2.15 | 1.88  | 2.1  |
| 18..... | 11.15 | 3.15  | 4.35   | 4.65   | 3.7  | 2.9   | 2.55  | 1.95 | 2.02  | 2.05 | 1.9   | 2.2  |
| 19..... | 11.15 | 3.0   | 4.45   | 4.25   | 7.2  | 2.95  | 2.35  | 2.0  | 1.92  | 2.0  | 1.9   | 2.2  |
| 20..... | 11.15 | 3.15  | 4.45   | 4.0    | 6.6  | 2.7   | 2.3   | 1.95 | 1.85  | 2.0  | 1.9   | 2.2  |
| 21..... | 11.15 | 3.65  | 5.1    | 3.8    | 6.7  | 3.25  | 2.75  | 2.35 | 2.2   | 1.9  | 2.05  | 2.15 |
| 22..... | 21.15 | 5.7   | 5.65   | 3.6    | 6.55 | 4.3   | 3.0   | 2.1  | 2.1   | 2.0  | 2.1   | 2.1  |
| 23..... | 10.95 | 5.45  | 8.15   | 3.45   | 6.2  | 4.75  | 3.25  | 2.4  | 1.9   | 2.0  | 2.35  | 2.0  |
| 24..... | 7.5   | 6.05  | 7.85   | 3.35   | 4.9  | 3.45  | 2.8   | 2.55 | 1.85  | 2.1  | 2.45  | 2.6  |
| 25..... | 5.95  | 5.4   | 6.4    | 3.55   | 4.45 | 3.3   | 2.6   | 2.55 | 1.8   | 2.1  | 2.4   | 8.2  |
| 26..... | 5.05  | 4.65  | 5.85   | 4.7    | 4.1  | 2.95  | 2.45  | 2.4  | 1.75  | 2.0  | 2.4   | 7.2  |
| 27..... | 4.4   | 4.2   | 6.0    | 6.75   | 4.05 | 2.85  | 2.55  | 2.2  | 1.75  | 2.0  | 2.35  | 7.2  |
| 28..... | 3.8   | 3.95  | 5.3    | 7.4    | 4.15 | 2.85  | 2.45  | 2.05 | 1.62  | 2.1  | 2.05  | 6.8  |
| 29..... | 3.75  | 5.15  | 4.65   | 6.5    | 3.9  | 3.05  | 2.5   | 1.95 | 1.6   | 2.0  | 2.1   | 5.4  |
| 30..... | 3.65  | ..... | 4.3    | 6.05   | 3.7  | 3.8   | 2.35  | 1.85 | 1.6   | 2.0  | 2.0   | 4.2  |
| 31..... | 3.6   | ..... | 4.35   | .....  | 3.55 | ..... | 2.2   | 1.85 | ..... | 2.0  | ..... | 3.85 |

**Note.**—Discharge affected by ice conditions from about January 11 to 27 and about December 14 to 19, 1903, as determined by temperature records. The temperature was very low for a few days about February 18 and 19, 1903, but the discharge was probably not greatly affected by ice conditions owing to the flood which immediately preceded this period.

**Note.**—Ice gorge from January 3 to 23, 1904. No ice during December on basis of comparison with chain gage heights.

Daily gage heights, in feet, of Cheat River near Morgantown, W. Va., for 1899, 1900, 1902 to 1905, 1908, and 1909—Continued.

| Day.    | Jan. | Feb.  | March. | April. | May. | June. | July. | Aug. | Sept. | Oct. | Nov.  | Dec. |
|---------|------|-------|--------|--------|------|-------|-------|------|-------|------|-------|------|
| 1905.   |      |       |        |        |      |       |       |      |       |      |       |      |
| 1.....  | 3.8  | 2.95  | 5.35   | 4.1    | 4.4  | 5.9   | 3.7   | 4.05 | 2.7   | 2.0  | 3.55  | 5.2  |
| 2.....  | 3.6  | 2.85  | 4.55   | 4.0    | 4.05 | 5.25  | 4.15  | 3.8  | 2.65  | 2.0  | 3.35  | 4.7  |
| 3.....  | 3.6  | 2.9   | 4.1    | 3.85   | 3.85 | 4.4   | 3.8   | 3.45 | 2.5   | 2.0  | 3.15  | 8.25 |
| 4.....  | 3.65 | 2.85  | 3.75   | 3.8    | 3.7  | 3.75  | 3.65  | 3.05 | 2.5   | 2.1  | 3.1   | 8.0  |
| 5.....  | 3.45 | 2.9   | 3.7    | 3.8    | 3.8  | 3.55  | 4.75  | 2.9  | 2.45  | 2.05 | 3.0   | 6.15 |
| 6.....  | 3.4  | 2.9   | 4.7    | 4.2    | 4.35 | 3.4   | 4.15  | 3.4  | 2.4   | 2.1  | 3.05  | 5.1  |
| 7.....  | 3.45 | 3.1   | 5.55   | 4.9    | 3.95 | 3.5   | 3.8   | 3.2  | 2.4   | 2.1  | 3.4   | 4.55 |
| 8.....  | 3.35 | 3.4   | 8.2    | 5.05   | 3.8  | 3.65  | 3.8   | 3.35 | 2.35  | 2.1  | 3.6   | 4.2  |
| 9.....  | 3.2  | 3.85  | 11.25  | 4.85   | 3.8  | 3.45  | 4.05  | 3.05 | 2.3   | 2.1  | 3.5   | 4.0  |
| 10..... | 3.2  | 5.95  | 12.65  | 4.8    | 3.55 | 3.3   | 3.7   | 3.15 | 2.3   | 2.0  | 3.45  | 3.9  |
| 11..... | 3.3  | 4.8   | 8.75   | 5.8    | 3.45 | 3.15  | 3.65  | 3.15 | 2.85  | 2.0  | 3.35  | 3.6  |
| 12..... | 6.45 | 4.35  | 7.05   | 5.75   | 7.3  | 3.65  | 3.6   | 3.15 | 4.15  | 2.3  | 3.1   | 3.55 |
| 13..... | 9.85 | 7.4   | 6.2    | 4.75   | 7.45 | 4.55  | 3.75  | 3.0  | 4.1   | 3.4  | 3.0   | 3.45 |
| 14..... | 7.05 | 6.25  | 5.8    | 4.6    | 5.9  | 4.25  | 4.45  | 3.3  | 3.6   | 3.2  | 3.0   | 3.4  |
| 15..... | 5.45 | 8.5   | 5.4    | 4.4    | 8.5  | 3.6   | 3.85  | 5.2  | 3.05  | 2.9  | 2.9   | 3.3  |
| 16..... | 4.85 | 8.3   | 5.2    | 4.2    | 6.75 | 3.25  | 3.65  | 5.6  | 2.9   | 2.8  | 8.0   | 3.2  |
| 17..... | 3.95 | 8.35  | 5.75   | 4.05   | 6.2  | 3.0   | 3.45  | 5.45 | 2.7   | 2.55 | 3.4   | 3.15 |
| 18..... | 3.85 | 7.65  | 6.05   | 3.8    | 5.25 | 3.0   | 3.1   | 4.3  | 2.65  | 2.4  | 3.55  | 3.1  |
| 19..... | 3.8  | 6.7   | 6.85   | 3.7    | 4.8  | 3.0   | 2.9   | 4.0  | 2.5   | 2.45 | 3.4   | 3.2  |
| 20..... | 3.8  | 6.55  | 8.2    | 3.7    | 4.45 | 3.0   | 3.8   | 3.5  | 2.45  | 6.6  | 3.35  | 3.2  |
| 21..... | 3.8  | 6.55  | 10.85  | 4.6    | 4.1  | 3.05  | 4.3   | 3.45 | 2.4   | 6.0  | 3.05  | 5.1  |
| 22..... | 3.6  | 7.0   | 9.35   | 5.65   | 3.85 | 5.3   | 3.7   | 3.05 | 2.3   | 5.2  | 2.8   | 5.85 |
| 23..... | 3.5  | 8.0   | 7.25   | 5.35   | 3.55 | 5.25  | 3.8   | 2.9  | 2.3   | 4.65 | 2.65  | 5.95 |
| 24..... | 3.4  | 7.9   | 6.1    | 4.65   | 3.5  | 4.85  | 5.5   | 2.75 | 2.25  | 3.25 | 2.45  | 6.05 |
| 25..... | 3.2  | 7.5   | 6.65   | 4.35   | 3.3  | 5.9   | 4.35  | 4.35 | 2.2   | 3.1  | 3.3   | 4.95 |
| 26..... | 2.8  | 7.85  | 6.55   | 4.05   | 3.2  | 5.0   | 3.7   | 5.25 | 2.1   | 4.15 | 3.3   | 4.15 |
| 27..... | 2.95 | 7.25  | 6.05   | 4.35   | 3.1  | 6.9   | 3.55  | 4.25 | 2.1   | 5.25 | 3.3   | 4.2  |
| 28..... | 2.9  | 6.3   | 5.6    | 5.9    | 3.0  | 5.45  | 3.25  | 3.75 | 2.1   | 4.55 | 3.3   | 4.0  |
| 29..... | 2.95 | ..... | 5.1    | 5.4    | 3.0  | 4.5   | 3.2   | 3.55 | 2.0   | 3.9  | 5.1   | 4.15 |
| 30..... | 3.0  | ..... | 4.85   | 4.95   | 2.95 | 3.9   | 5.15  | 2.9  | 2.0   | 3.8  | 7.3   | 4.25 |
| 31..... | 3.15 | ..... | 4.65   | .....  | 3.2  | ..... | 4.6   | 2.9  | ..... | 3.65 | ..... | 4.15 |

| Day.  | Nov.  | Dec. | Day. | Nov.  | Dec. | Day. | Nov.  | Dec. |
|-------|-------|------|------|-------|------|------|-------|------|
| 1908. |       |      |      |       |      |      |       |      |
| 1     | ..... | 1.71 | 11   | ..... | 2.00 | 21   | 1.61  | 3.40 |
| 2     | ..... | 1.71 | 12   | ..... | 2.32 | 22   | 1.61  | 2.78 |
| 3     | ..... | 1.66 | 13   | ..... | 3.05 | 23   | 1.74  | 2.60 |
| 4     | ..... | 1.66 | 14   | ..... | 2.90 | 24   | 1.81  | 2.57 |
| 5     | ..... | 1.66 | 15   | ..... | 2.65 | 25   | 1.81  | 2.50 |
| 6     | ..... | 1.66 | 16   | ..... | 2.35 | 26   | 1.81  | 2.32 |
| 7     | ..... | 1.66 | 17   | ..... | 2.44 | 27   | 1.76  | 2.35 |
| 8     | ..... | 1.86 | 18   | 1.61  | 2.70 | 28   | 1.76  | 2.40 |
| 9     | ..... | 1.86 | 19   | 1.61  | 4.65 | 29   | 1.71  | 2.42 |
| 10    | ..... | 1.99 | 20   | 1.61  | 4.00 | 30   | 1.71  | 2.40 |
|       |       |      |      |       |      | 31   | ..... | 2.35 |

| Day.    | Jan. | Feb. | March. | April. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---------|------|------|--------|--------|------|-------|-------|------|-------|------|------|------|
| 1909.   |      |      |        |        |      |       |       |      |       |      |      |      |
| 1.....  | 3.44 | 3.20 | 5.00   | 4.50   | 5.44 | 3.14  | 3.56  | 5.30 | 3.12  | 2.67 | 3.37 | 3.16 |
| 2.....  | 2.98 | 3.10 | 4.73   | 4.39   | 6.36 | 5.08  | 3.50  | 4.24 | 2.86  | 2.60 | 3.40 | 3.09 |
| 3.....  | 2.82 | 3.20 | 5.36   | 5.10   | 6.57 | 5.18  | 3.38  | 3.75 | 2.75  | 2.56 | 3.21 | 3.00 |
| 4.....  | 2.68 | 3.35 | 6.68   | 5.44   | 5.38 | 4.49  | 3.06  | 3.34 | 2.80  | 2.45 | 3.14 | 2.91 |
| 5.....  | 2.70 | 3.62 | 5.63   | 5.71   | 5.25 | 5.66  | 2.87  | 3.11 | 2.92  | 2.43 | 3.11 | 2.87 |
| 6.....  | 2.78 | 4.95 | 5.08   | 6.08   | 4.84 | 7.21  | 2.75  | 2.97 | 2.87  | 2.36 | 3.01 | 2.85 |
| 7.....  | 3.65 | 5.25 | 4.90   | 5.97   | 4.43 | 5.82  | 2.64  | 2.87 | 2.91  | 2.29 | 3.09 | 2.80 |
| 8.....  | 3.56 | 4.80 | 5.90   | 5.38   | 4.14 | 5.14  | 2.54  | 2.80 | 2.76  | 2.26 | 2.86 | 3.27 |
| 9.....  | 3.08 | 4.30 | 5.95   | 4.53   | 3.98 | 7.02  | 2.54  | 2.70 | 2.68  | 2.24 | 3.03 | 3.04 |
| 10..... | 3.18 | 5.96 | 6.92   | 4.47   | 3.89 | 6.20  | 2.52  | 2.61 | 2.65  | 2.21 | 3.05 | 2.87 |
| 11..... | 3.10 | 6.90 | 6.66   | 4.20   | 3.68 | 7.68  | 2.43  | 2.54 | 6.00  | 2.24 | 4.82 | 2.82 |
| 12..... | 3.13 | 5.45 | 6.54   | 4.12   | 4.11 | 6.57  | 2.34  | 2.50 | 4.45  | 2.82 | 4.32 | 2.75 |
| 13..... | 3.45 | 5.00 | 4.98   | 4.20   | 3.75 | 5.29  | 2.41  | 2.42 | 3.70  | 4.66 | 3.98 | 2.94 |
| 14..... | 3.47 | 5.50 | 4.80   | 8.28   | 3.56 | 5.15  | 2.49  | 2.32 | 3.25  | 3.72 | 3.70 | 5.59 |
| 15..... | 8.75 | 5.50 | 5.07   | 8.04   | 3.40 | 5.35  | 2.45  | 2.52 | 3.06  | 3.32 | 3.53 | 5.46 |
| 16..... | 7.40 | 7.20 | 4.56   | 6.22   | 3.28 | 5.11  | 2.68  | 3.98 | 5.43  | 3.42 | 3.36 | 4.57 |
| 17..... | 5.75 | 7.12 | 4.30   | 5.33   | 3.14 | 4.80  | 2.50  | 5.35 | 5.00  | 3.53 | 3.24 | 3.98 |
| 18..... | 4.80 | 5.94 | 4.14   | 4.78   | 3.03 | 6.94  | 2.39  | 4.57 | 4.06  | 3.38 | 3.19 | 3.95 |
| 19..... | 4.05 | 5.16 | 3.94   | 4.40   | 2.99 | 6.13  | 2.36  | 3.95 | 3.45  | 3.36 | 3.20 | 3.74 |
| 20..... | 4.00 | 5.20 | 4.12   | 4.36   | 2.89 | 5.07  | 2.31  | 3.61 | 3.11  | 4.09 | 3.11 | 3.65 |
| 21..... | 4.13 | 5.73 | 4.18   | 7.09   | 2.86 | 4.38  | 2.28  | 4.16 | 2.92  | 3.92 | 3.01 | 3.23 |
| 22..... | 4.37 | 5.40 | 4.02   | 9.06   | 3.06 | 4.00  | 2.26  | 3.37 | 2.82  | 3.71 | 3.01 | 2.91 |
| 23..... | 4.58 | 5.47 | 3.83   | 7.84   | 4.19 | 3.86  | 2.34  | 3.19 | 2.73  | 4.00 | 3.04 | 2.65 |
| 24..... | 5.80 | 7.95 | 3.68   | 7.50   | 3.60 | 3.72  | 2.41  | 2.99 | 2.87  | 9.16 | 3.11 | .... |
| 25..... | 5.40 | 7.58 | 3.86   | 6.32   | 3.40 | 3.45  | 3.41  | 2.83 | 4.16  | 6.59 | .... | 2.77 |
| 26..... | 4.80 | 6.30 | 4.58   | 5.71   | 3.24 | 3.29  | 3.11  | 2.68 | 3.64  | 5.37 | 3.53 | 2.65 |
| 27..... | 4.40 | 5.64 | 5.27   | 5.46   | 3.38 | 3.16  | 2.77  | 2.63 | 3.21  | 4.71 | 3.37 | 2.87 |
| 28..... | 3.85 | 5.34 | 5.18   | 5.18   | 3.98 | 3.49  | 2.63  | 2.54 | 3.07  | 4.24 | 3.19 | 2.83 |
| 29..... | 3.60 | .... | 5.48   | 5.00   | 4.00 | 4.19  | 2.58  | 2.68 | 2.87  | 3.88 | 3.11 | 2.68 |
| 30..... | 3.80 | .... | 5.07   | 4.90   | 3.56 | 3.95  | 2.63  | 3.70 | 2.77  | 3.72 | 3.06 | 2.61 |
| 31..... | 3.45 | .... | 4.78   | ....   | 3.34 | ....  | 8.53  | 3.51 | ....  | 3.49 | .... | 2.45 |

**Note.**—High gage heights February 13 to about March 3 caused by backwater from ice gorge. Ice conditions probably prevailed from about January 27 to March 3. No ice during December on the basis of comparison with chain gage heights.

**Note.**—Discharge unaffected by ice conditions during December, 1908.

**Note.**—Discharge probably unaffected by ice conditions January to March, 1909. Discharge about December 10 to 13 and 18 to 31, 1909, affected by ice conditions.

## Rating tables for Cheat River near Morgantown, W. Va.

1899 and 1900 (Referred to first staff gage).

| Gage height. | Dis-charge. | Gage height. | Dis-charge. | Gage height. | Dis-charge. | Gage height. | Dis-charge. |
|--------------|-------------|--------------|-------------|--------------|-------------|--------------|-------------|
| Feet.        | Sec.-ft.    | Feet.        | Sec.-ft.    | Feet.        | Sec.-ft.    | Feet.        | Sec.-ft.    |
| 1.30         | 165         | 2.50         | 970         | 3.70         | 3,500       | 4.90         | 7,790       |
| 1.40         | 200         | 2.60         | 1,100       | 3.80         | 3,820       | 5.00         | 8,180       |
| 1.50         | 240         | 2.70         | 1,240       | 3.90         | 4,150       | 5.20         | 8,970       |
| 1.60         | 280         | 2.80         | 1,400       | 4.00         | 4,490       | 5.40         | 9,770       |
| 1.70         | 325         | 2.90         | 1,570       | 4.10         | 4,830       | 5.60         | 10,570      |
| 1.80         | 375         | 3.00         | 1,750       | 4.20         | 5,180       | 5.80         | 11,380      |
| 1.90         | 430         | 3.10         | 1,940       | 4.30         | 5,540       | 6.00         | 12,200      |
| 2.00         | 495         | 3.20         | 2,150       | 4.40         | 5,900       | 6.20         | 13,020      |
| 2.10         | 570         | 3.30         | 2,380       | 4.50         | 6,270       | 6.40         | 13,840      |
| 2.20         | 655         | 3.40         | 2,630       | 4.60         | 6,640       | 6.60         | 14,670      |
| 2.30         | 750         | 3.50         | 2,900       | 4.70         | 7,020       | 6.80         | 15,510      |
| 2.40         | 855         | 3.60         | 3,190       | 4.80         | 7,400       | 7.00         | 16,350      |

Note.—The above table is not applicable for ice or obstructed-channel conditions. It is based on four discharge measurements made 1899-1901 and is fairly well defined. Above gage height 3.0 feet the rating curve is based on the form of the rating referred to the chain gage at Ice's ferry bridge and should be accurate. This table applies to original gage located about 100 feet above the present Ice's ferry bridge.

1902 to 1909. (Referred to second staff gage.)

| Gage height. | Dis-charge. | Gage height. | Dis-charge. | Gage height. | Dis-charge. | Gage height. | Dis-charge. |
|--------------|-------------|--------------|-------------|--------------|-------------|--------------|-------------|
| Feet.        | Sec.-ft.    | Feet.        | Sec.-ft.    | Feet.        | Sec.-ft.    | Feet.        | Sec.-ft.    |
| 1.50         | 110         | 2.90         | 735         | 4.30         | 2,670       | 6.40         | 8,210       |
| 1.60         | 135         | 3.00         | 815         | 4.40         | 2,880       | 6.60         | 8,830       |
| 1.70         | 160         | 3.10         | 905         | 4.50         | 3,090       | 6.80         | 9,450       |
| 1.80         | 190         | 3.20         | 1,005       | 4.60         | 3,310       | 7.00         | 10,080      |
| 1.90         | 220         | 3.30         | 1,110       | 4.70         | 3,530       | 7.20         | 10,720      |
| 2.00         | 255         | 3.40         | 1,220       | 4.80         | 3,760       | 7.40         | 11,370      |
| 2.10         | 290         | 3.50         | 1,340       | 4.90         | 4,000       | 7.60         | 12,030      |
| 2.20         | 330         | 3.60         | 1,470       | 5.00         | 4,250       | 7.80         | 12,690      |
| 2.30         | 375         | 3.70         | 1,610       | 5.20         | 4,760       | 8.00         | 13,370      |
| 2.40         | 420         | 3.80         | 1,760       | 5.40         | 5,300       | 9.00         | 16,830      |
| 2.50         | 470         | 3.90         | 1,920       | 5.60         | 5,860       | 10.00        | 20,430      |
| 2.60         | 525         | 4.00         | 2,090       | 5.80         | 6,430       | 11.00        | 24,180      |
| 2.70         | 590         | 4.10         | 2,280       | 6.00         | 7,010       | 12.00        | 27,980      |
| 2.80         | 660         | 4.20         | 2,470       | 6.20         | 7,610       | 13.00        | 31,880      |

Note.—The above table is not applicable for ice or obstructed-channel conditions. It is based on thirteen discharge measurements made during 1902 to 1909 and is well defined between gage heights, 1.6



Daily discharge, in second-feet, of Cheat River near Morgantown,  
W. Va., for 1899, 1900, 1902 to 1905, 1908, and 1909.

| Day. | July. | Aug.  | Sept. | Oct. | Nov.  | Dec.   | Day. | July. | Aug. | Sept. | Oct. | Nov.  | Dec.  |
|------|-------|-------|-------|------|-------|--------|------|-------|------|-------|------|-------|-------|
| 1899 |       |       |       |      |       |        | 1899 |       |      |       |      |       |       |
| 1    | ....  | 1,750 | 655   | 495  | 3,500 | 1,570  | 16   | 1,400 | 750  | 1,400 | 325  | 970   | 3,820 |
| 2    | ....  | 1,400 | 495   | 495  | 4,490 | 1,400  | 17   | 2,900 | 855  | 1,240 | 375  | 855   | 2,630 |
| 3    | ....  | 1,240 | 750   | 430  | 3,820 | 1,240  | 18   | 2,630 | 750  | 750   | 375  | 855   | 2,150 |
| 4    | ....  | 970   | 655   | 430  | 2,900 | 1,240  | 19   | 1,750 | 655  | 655   | 325  | 970   | 1,750 |
| 5    | ....  | 2,630 | 655   | 430  | 2,380 | 1,100  | 20   | 1,400 | 570  | 495   | 325  | 2,630 | 7,400 |
| 6    | ....  | 2,380 | 655   | 430  | 1,940 | 1,100  | 21   | 855   | 495  | 430   | 280  | 2,630 | 5,900 |
| 7    | ....  | 1,750 | 570   | 375  | 570   | 970    | 22   | 855   | 495  | 430   | 280  | 2,150 | 4,830 |
| 8    | 1,100 | 1,400 | 495   | 375  | 570   | 970    | 23   | 855   | 430  | 750   | 280  | 1,750 | 4,150 |
| 9    | 1,750 | 1,240 | 495   | 375  | 1,400 | 970    | 24   | 750   | 430  | 655   | 280  | 1,750 | 8,970 |
| 10   | 1,400 | 1,100 | 655   | 325  | 1,240 | 970    | 25   | 970   | 375  | 655   | 280  | 4,150 | 5,900 |
| 11   | 1,240 | 970   | 4,830 | 325  | 1,100 | 1,240  | 26   | 1,240 | 375  | 570   | 325  | 3,500 | 3,190 |
| 12   | 970   | 855   | 3,820 | 325  | 1,570 | 10,200 | 27   | 1,400 | 375  | 750   | 325  | 2,900 | 2,150 |
| 13   | 855   | 750   | 2,900 | 325  | 1,240 | 13,800 | 28   | 1,100 | 970  | 555   | 325  | 2,380 | 1,570 |
| 14   | 970   | 655   | 2,150 | 325  | 1,100 | 7,400  | 29   | 970   | 855  | 750   | 325  | 1,940 | 1,240 |
| 15   | 1,400 | 655   | 1,750 | 325  | 1,100 | 5,180  | 30   | 2,900 | 750  | 655   | 325  | 1,940 | 1,100 |
|      |       |       |       |      |       |        | 31   | 3,190 | 750  | ....  | 325  | ....  | 970   |

| Day. | July. | Aug.  | Sept. | Oct. | Nov. | Dec.   | Day. | July. | Aug. | Sept. | Oct. | Nov.   | Dec.  |
|------|-------|-------|-------|------|------|--------|------|-------|------|-------|------|--------|-------|
| 1900 |       |       |       |      |      |        | 1900 |       |      |       |      |        |       |
| 1    | 2,150 | 2,150 | 750   | 570  | 280  | 6,270  | 16   | 1,100 | 280  | 200   | 200  | 655    | 1,750 |
| 2    | 1,400 | 1,940 | 570   | 495  | 280  | 4,490  | 17   | 1,400 | 280  | 200   | 200  | 655    | 1,570 |
| 3    | 1,240 | 1,570 | 495   | 430  | 325  | 4,400  | 18   | 1,570 | 240  | 200   | 200  | 570    | 1,400 |
| 4    | 1,100 | 1,240 | 430   | 375  | 325  | 5,540  | 19   | 1,570 | 240  | 200   | 240  | 655    | 1,400 |
| 5    | 1,100 | 1,100 | 260   | 325  | 280  | 16,400 | 20   | 1,750 | 280  | 200   | 200  | 1,750  | 1,240 |
| 6    | 855   | 855   | 240   | 280  | 495  | 16,400 | 21   | 1,750 | 495  | 165   | 165  | 2,380  | 1,240 |
| 7    | 750   | 855   | 200   | 240  | 750  | 12,200 | 22   | 1,750 | 430  | 240   | 165  | 2,900  | 1,100 |
| 8    | 1,750 | 750   | 200   | 280  | 970  | 8,180  | 23   | 1,570 | 375  | 240   | 165  | 3,820  | 1,750 |
| 9    | 1,570 | 495   | 200   | 325  | 855  | 5,900  | 24   | 2,900 | 375  | 200   | 750  | 4,490  | 2,150 |
| 10   | 1,570 | 495   | 200   | 325  | 655  | 7,020  | 25   | 7,400 | 375  | 200   | 750  | 8,180  | 2,380 |
| 11   | 1,400 | 495   | 200   | 325  | 495  | 2,630  | 26   | 8,570 | 375  | 240   | 655  | 14,000 | 2,380 |
| 12   | 1,240 | 375   | 200   | 325  | 430  | 2,630  | 27   | 8,970 | 325  | 165   | 570  | 20,000 | 2,150 |
| 13   | 1,100 | 325   | 165   | 280  | 430  | 2,150  | 28   | 7,790 | 325  | 165   | 495  | 13,800 | 1,940 |
| 14   | 970   | 325   | 165   | 240  | 430  | 1,750  | 29   | 3,500 | 495  | 200   | 375  | 9,770  | 1,940 |
| 15   | 1,100 | 325   | 165   | 240  | 495  | 1,750  | 30   | 2,630 | 750  | 200   | 325  | 8,180  | 2,900 |
|      |       |       |       |      |      |        | 31   | 2,150 | 750  | ....  | 280  | ....   | 2,900 |

| Day. | Aug. | Sept. | Oct.  | Nov. | Dec.   | Day. | Aug. | Sept. | Oct.  | Nov.   | Dec.   |
|------|------|-------|-------|------|--------|------|------|-------|-------|--------|--------|
| 1902 |      |       |       |      |        | 1902 |      |       |       |        |        |
| 1    | .... | 272   | 955   | 698  | 4,250  | 16   | .... | 190   | 1,540 | 498    | 22,700 |
| 2    | .... | 272   | 4,630 | 498  | 3,880  | 17   | .... | 175   | 1,160 | 498    | 18,100 |
| 3    | .... | 272   | 2,090 | 498  | 8,210  | 18   | .... | 175   | 955   | 498    | 12,200 |
| 4    | .... | 310   | 1,680 | 498  | 8,980  | 19   | .... | 205   | 815   | 398    | 7,010  |
| 5    | .... | 255   | 1,680 | 420  | 6,140  | 20   | .... | 175   | 660   | 398    | 2,670  |
| 6    | .... | 558   | 1,760 | 352  | 4,120  | 21   | 310  | 175   | 660   | 470    | 3,640  |
| 7    | .... | 398   | 1,220 | 470  | 3,090  | 22   | 352  | 148   | 590   | 625    | 5,720  |
| 8    | .... | 330   | 1,000 | 408  | 2,680  | 23   | 775  | 148   | 498   | 590    | 6,580  |
| 9    | .... | 272   | 775   | 625  | 2,670  | 24   | 860  | 148   | 498   | 905    | 4,630  |
| 10   | .... | 272   | 590   | 525  | 1,920  | 25   | 558  | 148   | 498   | 3,530  | 3,420  |
| 11   | .... | 272   | 498   | 498  | 8,660  | 26   | 420  | 190   | 445   | 13,900 | 2,670  |
| 12   | .... | 238   | 6,430 | 498  | 24,400 | 27   | 352  | 272   | 498   | 9,920  | 1,760  |
| 13   | .... | 238   | 5,030 | 498  | 22,800 | 28   | 310  | 238   | 905   | 6,140  | 1,400  |
| 14   | .... | 205   | 3,640 | 525  | 17,200 | 29   | 272  | 398   | 775   | 4,000  | 1,610  |
| 15   | .... | 205   | 2,280 | 498  | 9,600  | 30   | 272  | 420   | 775   | 2,880  | 4,500  |
|      |      |       |       |      |        | 31   | 272  | ....  | 698   | ....   | 4,000  |

Note.—Discharge estimated December 31, 1899.

Note.—Discharges November 25 to December 1 and December 30 and 31, 1900, estimated by a hydrograph comparison with Youghiogheny River at Friendsville, Md.

## Daily discharge in second-feet, of Cheat River near Morgantown, W. Va., for 1899, 1900, 1902 to 1905, 1908, and 1909—Continued.

| Day. | Jan.   | Feb.   | March  | April  | May    | June   | July  | Aug. | Sept. | Oct.  | Nov.  | Dec.  |
|------|--------|--------|--------|--------|--------|--------|-------|------|-------|-------|-------|-------|
| 1903 |        |        |        |        |        |        |       |      |       |       |       |       |
| 1    | 2,670  | 8,520  | 23,000 | 2,180  | 1,340  | 1,470  | 7,010 | 525  | 525   | 175   | 205   | 330   |
| 2    | 2,280  | 9,300  | 10,400 | 2,380  | 1,220  | 1,110  | 5,860 | 955  | 498   | 175   | 205   | 330   |
| 3    | 21,400 | 11,700 | 6,860  | 2,380  | 1,160  | 1,160  | 2,950 | 860  | 470   | 175   | 205   | 352   |
| 4    | 17,000 | 18,100 | 4,900  | 2,380  | 1,540  | 860    | 2,090 | 698  | 393   | 175   | 205   | 352   |
| 5    | 9,920  | 16,700 | 4,000  | 6,140  | 1,470  | 698    | 2,470 | 590  | 310   | 220   | 220   | 310   |
| 6    | 6,580  | 9,830  | 3,880  | 4,120  | 1,220  | 698    | 4,120 | 445  | 310   | 330   | 290   | 310   |
| 7    | 4,630  | 6,140  | 4,500  | 3,760  | 1,060  | 1,840  | 2,670 | 558  | 272   | 330   | 352   | 310   |
| 8    | 3,530  | 4,630  | 10,900 | 9,760  | 965    | 7,010  | 2,180 | 445  | 272   | 272   | 470   | 290   |
| 9    | 2,000  | 4,120  | 14,700 | 15,100 | 880    | 4,260  | 1,400 | 445  | 272   | 1,220 | 420   | 272   |
| 10   | 1,540  | 2,980  | 9,760  | 9,140  | 735    | 2,670  | 1,110 | 398  | 310   | 1,280 | 352   | 290   |
| 11   | 1,200  | 2,670  | 7,160  | 6,430  | 698    | 2,000  | 1,760 | 375  | 310   | 815   | 330   | 310   |
| 12   | 1,000  | 3,300  | 6,000  | 5,300  | 698    | 4,630  | 2,670 | 352  | 290   | 525   | 310   | 255   |
| 13   | 700    | 7,310  | 5,080  | 5,030  | 590    | 10,200 | 4,500 | 352  | 255   | 445   | 290   | 310   |
| 14   | 500    | 5,030  | 4,120  | 4,500  | 558    | 10,800 | 6,000 | 290  | 238   | 525   | 272   | 250   |
| 15   | 400    | 7,010  | 2,880  | 4,120  | 525    | 11,200 | 3,640 | 290  | 205   | 445   | 272   | 250   |
| 16   | 500    | 25,100 | 2,570  | 6,580  | 660    | 7,610  | 2,180 | 272  | 305   | 398   | 272   | 200   |
| 17   | 700    | 14,700 | 2,380  | 6,580  | 590    | 4,500  | 1,470 | 272  | 205   | 352   | 498   | 300   |
| 18   | 700    | 8,360  | 2,000  | 6,580  | 525    | 2,980  | 1,470 | 272  | 205   | 352   | 5,860 | 200   |
| 19   | 500    | 4,760  | 1,680  | 5,930  | 498    | 2,180  | 1,400 | 310  | 398   | 420   | 3,090 | 250   |
| 20   | 700    | 4,500  | 1,470  | 3,640  | 445    | 1,840  | 2,880 | 330  | 785   | 590   | 1,470 | 445   |
| 21   | 800    | 3,690  | 3,530  | 2,880  | 420    | 4,760  | 3,420 | 310  | 420   | 498   | 905   | 2,780 |
| 22   | 700    | 2,780  | 5,720  | 2,570  | 375    | 4,000  | 1,760 | 698  | 330   | 445   | 735   | 2,570 |
| 23   | 700    | 2,000  | 13,700 | 2,090  | 558    | 4,250  | 1,220 | 470  | 272   | 398   | 698   | 1,700 |
| 24   | 600    | 2,380  | 19,200 | 1,760  | 1,840  | 6,000  | 905   | 375  | 255   | 352   | 625   | 1,160 |
| 25   | 700    | 2,470  | 9,300  | 1,920  | 3,310  | 3,640  | 698   | 290  | 238   | 310   | 525   | 3,760 |
| 26   | 800    | 2,180  | 6,140  | 1,220  | 6,000  | 2,180  | 558   | 272  | 205   | 255   | 525   | 6,140 |
| 27   | 1,000  | 2,670  | 4,120  | 2,380  | 8,920  | 1,540  | 498   | 272  | 205   | 272   | 420   | 2,880 |
| 28   | 8,210  | 25,900 | 3,200  | 2,380  | 5,300  | 2,260  | 398   | 290  | 205   | 272   | 420   | 1,840 |
| 29   | 15,600 | .....  | 2,380  | 1,920  | 3,420  | 16,300 | 445   | 290  | 205   | 272   | 352   | 1,340 |
| 30   | 16,500 | .....  | 2,180  | 1,540  | 2,470  | 12,400 | 420   | 290  | 175   | 238   | 352   | 1,340 |
| 31   | 14,400 | .....  | 2,180  | .....  | 2,000  | .....  | 398   | 525  | ..... | 238   | ..... | 1,000 |
| 1904 |        |        |        |        |        |        |       |      |       |       |       |       |
| 1    | 1,110  | 1,470  | 8,680  | 8,830  | 7,760  | 1,220  | 1,470 | 310  | 190   | 135   | 255   | 225   |
| 2    | 1,060  | 815    | 9,450  | 9,140  | 6,580  | 1,280  | 2,090 | 352  | 205   | 205   | 255   | 272   |
| 3    | 4,000  | 1,060  | 10,700 | 6,860  | 4,120  | 1,340  | 1,540 | 310  | 205   | 220   | 220   | 330   |
| 4    | 1,800  | 955    | 14,600 | 4,500  | 4,250  | 1,920  | 1,160 | 398  | 205   | 220   | 220   | 290   |
| 5    | 1,400  | 815    | 8,680  | 3,200  | 3,200  | 1,840  | 815   | 498  | 205   | 220   | 220   | 290   |
| 6    | 1,000  | 815    | 5,580  | 2,670  | 2,470  | 3,760  | 815   | 398  | 190   | 205   | 220   | 525   |
| 7    | 900    | 4,000  | 7,310  | 2,380  | 2,000  | 2,670  | 1,540 | 352  | 175   | 205   | 196   | 470   |
| 8    | 800    | 15,600 | 11,500 | 2,180  | 1,680  | 2,280  | 1,340 | 375  | 175   | 220   | 190   | 470   |
| 9    | 800    | 8,360  | 9,140  | 2,180  | 1,400  | 1,840  | 1,220 | 310  | 175   | 190   | 190   | 470   |
| 10   | 800    | 5,160  | 6,140  | 2,380  | 1,680  | 1,610  | 1,110 | 272  | 175   | 220   | 190   | 420   |
| 11   | 800    | 3,420  | 4,630  | 2,090  | 1,680  | 1,340  | 1,400 | 272  | 175   | 238   | 190   | 398   |
| 12   | 800    | 2,090  | 4,380  | 1,840  | 1,280  | 1,110  | 1,340 | 255  | 175   | 255   | 190   | 330   |
| 13   | 800    | 1,470  | 4,000  | 1,760  | 1,110  | 905    | 1,160 | 272  | 175   | 272   | 190   | 310   |
| 14   | 800    | 1,540  | 3,200  | 1,840  | 1,060  | 735    | 860   | 272  | 205   | 625   | 190   | 272   |
| 15   | 800    | 1,760  | 4,630  | 1,610  | 1,220  | 698    | 660   | 272  | 205   | 375   | 220   | 310   |
| 16   | 800    | 1,220  | 4,120  | 2,090  | 1,610  | 698    | 590   | 238  | 238   | 330   | 238   | 310   |
| 17   | 800    | 775    | 2,880  | 4,380  | 1,540  | 625    | 498   | 238  | 238   | 310   | 214   | 290   |
| 18   | 900    | 955    | 2,780  | 3,420  | 1,610  | 735    | 498   | 238  | 238   | 272   | 220   | 330   |
| 19   | 1,200  | 815    | 2,980  | 2,570  | 10,700 | 775    | 398   | 255  | 227   | 255   | 220   | 330   |
| 20   | 4,000  | 955    | 2,980  | 2,090  | 8,830  | 590    | 375   | 238  | 205   | 255   | 220   | 330   |

| Day. | Jan.   | Feb.  | March. | April. | May.  | June. | July. | Aug. | Sept. | Oct. | Nov.  | Dec.   |
|------|--------|-------|--------|--------|-------|-------|-------|------|-------|------|-------|--------|
| 1904 |        |       |        |        |       |       |       |      |       |      |       |        |
| 21   | 9,600  | 1,540 | 4,500  | 1,760  | 9,140 | 1,060 | 625   | 398  | 330   | 220  | 272   | 310    |
| 22   | 15,000 | 6,140 | 6,000  | 1,470  | 8,680 | 2,670 | 815   | 290  | 290   | 255  | 290   | 290    |
| 23   | 21,000 | 5,430 | 13,900 | 1,280  | 7,610 | 3,640 | 1,080 | 420  | 220   | 255  | 398   | 255    |
| 24   | 11,700 | 7,160 | 12,900 | 1,160  | 4,000 | 1,280 | 660   | 498  | 205   | 290  | 445   | 525    |
| 25   | 8,800  | 5,300 | 8,210  | 1,400  | 2,980 | 1,110 | 525   | 498  | 190   | 290  | 420   | 14,000 |
| 26   | 4,380  | 3,420 | 6,580  | 3,530  | 2,280 | 775   | 445   | 420  | 175   | 255  | 420   | 10,700 |
| 27   | 2,860  | 2,470 | 7,010  | 9,300  | 2,180 | 698   | 498   | 330  | 175   | 255  | 398   | 10,700 |
| 28   | 1,760  | 2,000 | 5,030  | 11,400 | 2,380 | 698   | 445   | 272  | 140   | 290  | 272   | 9,450  |
| 29   | 1,680  | 4,630 | 3,420  | 8,520  | 1,920 | 860   | 470   | 238  | 135   | 255  | 290   | 5,300  |
| 30   | 1,540  | ..... | 2,670  | 7,160  | 1,610 | 1,760 | 398   | 205  | 135   | 255  | 255   | 2,470  |
| 31   | 1,470  | ..... | 2,780  | .....  | 1,400 | ..... | 330   | 205  | ..... | 255  | ..... | 1,840  |

Note.—Discharges January 11 to 27 and December 14 to 19, 1903, estimated on the basis of climatological reports on temperature and precipitation.

Note.—Discharge estimated for ice period, January 3 to 23, 1904, on the basis of climatological reports and a thorough study of run-off conditions during the period.

| Day. | Jan.   | Feb.  | March  | April | May    | June  | July  | Aug.  | Sept. | Oct.  | Nov.   | Dec.   |
|------|--------|-------|--------|-------|--------|-------|-------|-------|-------|-------|--------|--------|
| 1905 |        |       |        |       |        |       |       |       |       |       |        |        |
| 1    | 1,760  | 450   | 1,500  | 2,230 | 2,880  | 6,720 | 1,610 | 2,180 | 590   | 255   | 1,400  | 4,760  |
| 2    | 1,470  | 450   | 1,500  | 2,090 | 2,180  | 4,900 | 2,380 | 1,760 | 558   | 255   | 1,160  | 3,530  |
| 3    | 1,470  | 450   | 1,500  | 1,840 | 1,840  | 2,880 | 1,760 | 1,280 | 470   | 255   | 955    | 14,200 |
| 4    | 1,640  | 450   | 1,680  | 1,760 | 1,610  | 1,680 | 1,540 | 800   | 470   | 290   | 905    | 13,400 |
| 5    | 1,280  | 450   | 1,610  | 1,760 | 1,760  | 1,400 | 3,640 | 735   | 445   | 272   | 815    | 7,460  |
| 6    | 1,220  | 500   | 3,530  | 2,470 | 2,780  | 1,220 | 2,380 | 1,220 | 420   | 290   | 860    | 4,500  |
| 7    | 1,280  | 760   | 5,720  | 4,900 | 2,000  | 1,340 | 1,760 | 1,000 | 420   | 290   | 1,220  | 3,200  |
| 8    | 1,160  | 1,000 | 14,000 | 4,380 | 1,760  | 1,540 | 1,760 | 1,160 | 398   | 290   | 1,470  | 2,470  |
| 9    | 1,000  | 1,200 | 25,100 | 3,880 | 1,760  | 1,280 | 2,180 | 860   | 375   | 290   | 1,340  | 2,090  |
| 10   | 1,000  | 4,500 | 30,400 | 3,760 | 1,400  | 1,110 | 1,610 | 955   | 375   | 255   | 1,280  | 1,920  |
| 11   | 1,110  | 2,500 | 16,000 | 6,430 | 1,280  | 955   | 1,540 | 955   | 698   | 255   | 1,160  | 1,470  |
| 12   | 8,360  | 1,500 | 10,200 | 6,280 | 11,000 | 1,540 | 1,470 | 955   | 2,380 | 375   | 905    | 1,400  |
| 13   | 19,900 | 2,500 | 7,610  | 3,640 | 11,500 | 3,200 | 1,680 | 815   | 2,230 | 1,220 | 815    | 1,280  |
| 14   | 10,200 | 1,500 | 6,430  | 3,310 | 6,720  | 2,570 | 2,980 | 1,110 | 1,470 | 1,000 | 815    | 1,220  |
| 15   | 5,440  | 1,000 | 5,300  | 2,880 | 15,190 | 1,470 | 1,840 | 4,760 | 860   | 735   | 735    | 1,110  |
| 16   | 3,880  | 700   | 4,760  | 2,470 | 9,300  | 1,060 | 1,540 | 5,860 | 735   | 660   | 815    | 1,000  |
| 17   | 2,000  | 600   | 6,280  | 2,180 | 7,610  | 815   | 1,280 | 5,440 | 590   | 498   | 1,220  | 955    |
| 18   | 1,840  | 500   | 7,160  | 1,760 | 4,900  | 815   | 905   | 2,670 | 558   | 420   | 1,400  | 905    |
| 19   | 1,760  | 560   | 9,600  | 1,610 | 3,760  | 815   | 735   | 2,090 | 470   | 445   | 1,220  | 1,000  |
| 20   | 1,760  | 600   | 14,000 | 1,610 | 2,980  | 815   | 1,760 | 1,340 | 445   | 8,330 | 1,160  | 1,000  |
| 21   | 1,760  | 700   | 23,600 | 3,310 | 2,280  | 860   | 2,670 | 1,280 | 420   | 7,010 | 860    | 4,500  |
| 22   | 1,470  | 700   | 18,100 | 6,000 | 1,840  | 5,030 | 1,610 | 860   | 375   | 4,760 | 660    | 6,580  |
| 23   | 1,340  | 800   | 10,900 | 5,160 | 1,400  | 4,900 | 1,760 | 735   | 375   | 3,420 | 558    | 6,860  |
| 24   | 1,220  | 800   | 7,310  | 3,420 | 1,340  | 3,880 | 5,580 | 625   | 352   | 1,060 | 445    | 7,160  |
| 25   | 1,000  | 800   | 8,980  | 2,780 | 1,110  | 6,720 | 2,780 | 2,780 | 330   | 905   | 1,110  | 4,120  |
| 26   | 660    | 1,800 | 5,680  | 2,180 | 1,000  | 4,250 | 1,610 | 4,900 | 290   | 2,380 | 1,110  | 2,380  |
| 27   | 600    | 1,500 | 7,160  | 2,780 | 905    | 9,760 | 1,400 | 2,570 | 290   | 4,900 | 1,110  | 2,470  |
| 28   | 550    | 1,500 | 5,860  | 6,720 | 815    | 5,440 | 1,060 | 1,680 | 290   | 3,200 | 1,110  | 2,090  |
| 29   | 500    | ..... | 4,500  | 5,300 | 815    | 3,090 | 1,000 | 1,400 | 255   | 1,920 | 4,500  | 2,380  |
| 30   | 500    | ..... | 3,880  | 4,120 | 775    | 1,920 | 4,630 | 735   | 255   | 1,760 | 11,000 | 2,570  |
| 31   | 450    | ..... | 3,420  | ..... | 1,000  | ..... | 3,310 | 735   | ..... | 1,540 | .....  | 2,380  |

| Day. | Nov. | Dec. | Day. | Nov. | Dec.  | Day. | Nov. | Dec.  |
|------|------|------|------|------|-------|------|------|-------|
| 1908 |      |      | 1908 |      |       | 1908 |      |       |
| 1    | .... | 163  | 11   | .... | 255   | 21   | 138  | 1,220 |
| 2    | .... | 163  | 12   | .... | 384   | 22   | 138  | 646   |
| 3    | .... | 150  | 13   | .... | 860   | 23   | 172  | 525   |
| 4    | .... | 150  | 14   | .... | 735   | 24   | 193  | 508   |
| 5    | .... | 150  | 15   | .... | 558   | 25   | 193  | 470   |
| 6    | .... | 150  | 16   | .... | 398   | 26   | 193  | 384   |
| 7    | .... | 150  | 17   | .... | 440   | 27   | 178  | 398   |
| 8    | .... | 208  | 18   | 138  | 590   | 28   | 178  | 420   |
| 9    | .... | 208  | 19   | 138  | 3,420 | 29   | 163  | 430   |
| 10   | .... | 252  | 20   | 138  | 2,090 | 30   | 163  | 420   |
|      |      |      |      |      |       | 31   | .... | 398   |

| Day. | Jan.   | Feb.   | March | April  | May   | June   | July   | Aug.  | Sept. | Oct.   | Nov.  | Dec.  |
|------|--------|--------|-------|--------|-------|--------|--------|-------|-------|--------|-------|-------|
| 1909 |        |        |       |        |       |        |        |       |       |        |       |       |
| 1    | 1,270  | 1,000  | 4,250 | 3,090  | 5,410 | 945    | 1,420  | 5,030 | 925   | 570    | 1,190 | 965   |
| 2    | 799    | 905    | 3,600 | 2,860  | 8,090 | 4,450  | 1,340  | 2,550 | 705   | 525    | 1,220 | 896   |
| 3    | 675    | 1,000  | 5,190 | 4,500  | 8,740 | 4,710  | 1,200  | 1,680 | 625   | 503    | 1,020 | 815   |
| 4    | 577    | 1,160  | 9,380 | 5,410  | 5,250 | 3,070  | 869    | 1,150 | 660   | 445    | 945   | 743   |
| 5    | 590    | 1,500  | 5,940 | 6,170  | 4,900 | 6,030  | 712    | 915   | 751   | 435    | 915   | 719   |
| 6    | 646    | 4,120  | 4,450 | 7,250  | 3,860 | 10,800 | 625    | 791   | 712   | 402    | 824   | 698   |
| 7    | 1,540  | 4,900  | 4,000 | 6,320  | 2,940 | 6,490  | 551    | 712   | 743   | 370    | 896   | 660   |
| 8    | 1,420  | 3,760  | 6,720 | 5,250  | 2,360 | 4,600  | 492    | 660   | 632   | 357    | 705   | 1,080 |
| 9    | 887    | 2,670  | 6,860 | 3,160  | 2,060 | 10,100 | 492    | 590   | 577   | 348    | 842   | 851   |
| 10   | 985    | 6,890  | 9,820 | 3,030  | 1,900 | 7,610  | 481    | 532   | 558   | 334    | 860   | 650   |
| 11   | 905    | 9,760  | 9,020 | 2,470  | 1,580 | 12,300 | 435    | 492   | 7,010 | 348    | 3,810 | 600   |
| 12   | 935    | 5,140  | 5,690 | 2,320  | 2,300 | 8,740  | 393    | 470   | 2,980 | 675    | 2,710 | 550   |
| 13   | 1,280  | 4,250  | 4,200 | 2,470  | 1,680 | 5,000  | 425    | 430   | 1,610 | 3,440  | 2,060 | 700   |
| 14   | 1,300  | 5,580  | 3,760 | 14,300 | 1,420 | 4,630  | 465    | 384   | 1,060 | 1,640  | 1,610 | 5,830 |
| 15   | 16,000 | 5,580  | 4,420 | 13,500 | 1,220 | 5,160  | 445    | 481   | 869   | 1,130  | 1,380 | 5,470 |
| 16   | 11,400 | 10,700 | 3,220 | 7,670  | 1,090 | 4,530  | 577    | 2,060 | 5,380 | 1,240  | 1,180 | 3,240 |
| 17   | 6,280  | 10,500 | 2,670 | 5,110  | 945   | 3,760  | 470    | 5,160 | 4,250 | 1,380  | 1,050 | 2,060 |
| 18   | 3,760  | 6,840  | 2,360 | 3,710  | 842   | 9,890  | 416    | 3,240 | 2,200 | 1,200  | 995   | 1,500 |
| 19   | 2,180  | 4,660  | 1,990 | 2,880  | 807   | 7,400  | 402    | 2,000 | 1,280 | 1,180  | 1,000 | 1,200 |
| 20   | 2,090  | 4,760  | 2,320 | 2,800  | 728   | 4,420  | 380    | 1,480 | 915   | 2,260  | 915   | 1,000 |
| 21   | 2,340  | 3,230  | 2,430 | 10,400 | 705   | 2,840  | 366    | 2,390 | 751   | 1,950  | 824   | 800   |
| 22   | 2,820  | 5,300  | 2,130 | 17,000 | 869   | 2,090  | 357    | 1,190 | 675   | 1,620  | 824   | 500   |
| 23   | 3,270  | 5,500  | 1,810 | 12,800 | 2,450 | 1,860  | 393    | 995   | 611   | 2,090  | 851   | 450   |
| 24   | 6,430  | 13,200 | 1,580 | 11,700 | 1,470 | 1,640  | 425    | 807   | 712   | 17,400 | 915   | 450   |
| 25   | 5,300  | 12,000 | 1,860 | 7,970  | 1,220 | 1,280  | 1,230  | 682   | 2,390 | 8,800  | 1,140 | 450   |
| 26   | 3,760  | 7,910  | 3,270 | 6,170  | 1,050 | 1,100  | 915    | 577   | 1,530 | 5,220  | 1,380 | 400   |
| 27   | 2,880  | 5,970  | 4,950 | 5,470  | 1,200 | 965    | 639    | 544   | 1,020 | 3,550  | 1,190 | 450   |
| 28   | 1,840  | 5,140  | 4,710 | 4,710  | 2,060 | 1,330  | 544    | 492   | 878   | 2,550  | 995   | 400   |
| 29   | 1,470  | .....  | 5,520 | 4,250  | 2,090 | 2,450  | 514    | 577   | 712   | 1,890  | 915   | 350   |
| 30   | 1,760  | .....  | 4,420 | 4,000  | 1,420 | 2,000  | 544    | 1,610 | 639   | 1,640  | 869   | 300   |
| 31   | 1,280  | .....  | 3,710 | .....  | 1,150 | .....  | 15,200 | 1,350 | ..... | 1,330  | ..... | 250   |

Note.—Discharges January 27 to March 3, 1905, estimated on basis of climatological reports.

Note.—Discharge December 10 to 13 and 18 to 31, 1909, estimated on the basis of climatological data.

Monthly discharge of Cheat River near Morgantown, W. Va., for 1899,  
1900, 1902 to 1905, 1908, and 1909.

(Drainage area, 1,380 square miles).

| Month        | Discharge in second-feet. |         |       |                       | Run-off<br>(depth in<br>inches<br>on<br>drainage<br>area) | Accu-<br>racy |
|--------------|---------------------------|---------|-------|-----------------------|---|---------------|
|              | Maximum                   | Minimum | Mean  | Per<br>square<br>mile |   |               |
| 1899         |                           |         |       |                       |   |               |
| July 8-31... | 3,190                     | 750     | 1,450 | 1.05                  | 0.94  | A.            |
| August ..... | 2,630                     | 375     | 940   | .681                  | .79   | B.            |
| September .. | 4,830                     | 430     | 1,090 | .790                  | .88   | B.            |
| October .... | 495                       | 280     | 350   | .254                  | .29   | B.            |
| November ..  | 4,490                     | 570     | 2,010 | 1.46                  | 1.63  | A.            |
| December ..  | 13,800                    | 970     | 3,420 | 2.48                  | 2.86  | A.            |
| 1900         |                           |         |       |                       |   |               |
| July .....   | 8,970                     | 750     | 2,440 | 1.77                  | 2.04  | A.            |
| August ....  | 2,150                     | 240     | 635   | .460                  | .53   | B.            |
| September .. | 750                       | 165     | 249   | .180                  | .20   | B.            |
| October .... | 750                       | 165     | 348   | .252                  | .29   | B.            |
| November ..  | 20,000                    | 280     | 3,310 | 2.40                  | 2.68  | B.            |
| December ..  | 16,400                    | 1,100   | 4,130 | 2.99                  | 3.45  | A.            |
| 1902         |                           |         |       |                       |   |               |
| August 21-31 | 860                       | 272     | 432   | .313                  | .13   | A.            |
| September .. | 558                       | 148     | 252   | .183                  | .20   | A.            |
| October .... | 6,430                     | 445     | 1,490 | 1.08                  | 1.24  | A.            |
| November ..  | 13,900                    | 352     | 1,760 | 1.28                  | 1.43  | A.            |
| December ..  | 24,400                    | 1,400   | 7,410 | 5.37                  | 6.19  | A.            |
| 1903         |                           |         |       |                       |   |               |
| January b... | 21,400                    | 400     | 4,470 | 3.24                  | 3.74  | C.            |
| February ... | 25,900                    | 2,000   | 7,830 | 5.67                  | 5.90  | A.            |
| March .....  | 23,000                    | 1,470   | 6,450 | 4.67                  | 5.38  | A.            |
| April .....  | 15,100                    | 1,540   | 4,450 | 3.22                  | 1.41  | A.            |
| May .....    | 8,980                     | 375     | 1,680 | 1.22                  | 1.41  | A.            |
| June .....   | 16,300                    | 698     | 4,560 | 3.30                  | 3.68  | A.            |
| July .....   | 7,010                     | 398     | 2,280 | 1.65                  | 1.90  | A.            |
| August ..... | 955                       | 272     | 423   | .307                  | .35   | A.            |
| September .. | 735                       | 175     | 306   | .222                  | .25   | A.            |
| October .... | 1,280                     | 175     | 412   | .299                  | .34   | A.            |
| November ..  | 5,860                     | 205     | 705   | .511                  | .57   | A.            |
| December b.  | 6,140                     | 200     | 1,040 | .753                  | .87   | A.            |
| The year...  | 25,900                    | 175     | 2,880 | 2.09                  | 27.98   |               |

a Estimated from hydrograph comparison of this station with Youghiogheny River at Friendsville, Md.

b Ice conditions January 11 to 27, and December 14 to 19, 1903; discharge estimated.

| Month         | Discharge in second-feet. |         |       |                       | Run-off<br>(depth in<br>inches<br>on<br>drainage<br>area) | Accu-<br>racy |
|---------------|---------------------------|---------|-------|-----------------------|---|---------------|
|               | Maximum                   | Minimum | Mean  | Per<br>square<br>mile |   |               |
| <b>1904</b>   |                           |         |       |                       |   |               |
| January a...  | 21,000                    | 800     | 3,330 | 2.41                  | 2.78  | C.            |
| February ...  | 15,600                    | 775     | 3,180 | 2.30                  | 2.48  | A.            |
| March .....   | 14,600                    | 2,670   | 6,500 | 4.71                  | 5.43  | A.            |
| April .....   | 11,400                    | 1,160   | 3,830 | 2.78                  | 3.10  | A.            |
| May .....     | 10,700                    | 1,060   | 3,550 | 2.57                  | 2.96  | A.            |
| June .....    | 3,760                     | 590     | 1,420 | 1.03                  | 1.15  | A.            |
| July .....    | 2,090                     | 330     | 876   | .635                  | .73   | A.            |
| August .....  | 498                       | 205     | 319   | .231                  | .27   | A.            |
| September ..  | 330                       | 135     | 202   | .146                  | .16   | A.            |
| October ..... | 625                       | 135     | 261   | .189                  | .22   | A.            |
| November ..   | 445                       | 190     | 257   | .186                  | .21   | A.            |
| December ..   | 14,000                    | 255     | 2,030 | 1.47                  | 1.70  | A.            |
| The year..    | 21,000                    | 135     | 2,150 | 1.55                  | 21.19   |               |
| <b>1905</b>   |                           |         |       |                       |   |               |
| January a...  | 19,900                    | 450     | 2,560 | 1.86                  | 2.14  | A.            |
| February a... | 4,500                     | 450     | 1,090 | .790                  | .82   | D.            |
| March a....   | 30,400                    | 1,500   | 8,910 | 6.46                  | 7.45  | A.            |
| April .....   | 6,720                     | 1,610   | 3,410 | 2.47                  | 2.76  | A.            |
| May .....     | 15,100                    | 775     | 3,460 | 2.51                  | 2.89  | A.            |
| June .....    | 9,760                     | 815     | 2,800 | 2.03                  | 2.26  | A.            |
| July .....    | 5,580                     | 735     | 2,060 | 1.49                  | 1.72  | A.            |
| August .....  | 5,860                     | 625     | 1,820 | 1.32                  | 1.52  | A.            |
| September ..  | 2,380                     | 255     | 608   | .441                  | .49   | A.            |
| October ..... | 8,830                     | 255     | 1,610 | 1.17                  | 1.35  | A.            |
| November ..   | 11,000                    | 445     | 1,470 | 1.07                  | 1.19  | A.            |
| December ..   | 14,200                    | 905     | 3,620 | 2.62                  | 3.02  | A.            |
| The year..    | 30,400                    | 255     | 2,780 | 2.02                  | 27.61   |               |
| <b>1908</b>   |                           |         |       |                       |   |               |
| Nov. 18-30..  | 193                       | 138     | 163   | .118                  | .06   | A.            |
| December ..   | 3,420                     | 150     | 558   | .404                  | .47   | A.            |
| <b>1909</b>   |                           |         |       |                       |   |               |
| January ..... | 16,000                    | 577     | 2,860 | 2.07                  | 2.39  | A.            |
| February ...  | 13,200                    | 905     | 5,620 | 4.07                  | 4.24  | A.            |
| March .....   | 9,820                     | 1,580   | 4,390 | 3.18                  | 3.67  | A.            |
| April .....   | 17,000                    | 2,320   | 6,310 | 4.57                  | 5.10  | A.            |
| May .....     | 8,740                     | 705     | 2,380 | 1.72                  | 1.98  | A.            |
| June .....    | 12,300                    | 945     | 4,740 | 3.43                  | 3.83  | A.            |
| July .....    | 15,200                    | 357     | 1,090 | .790                  | .91   | A.            |
| August .....  | 5,160                     | 384     | 1,360 | .986                  | 1.14  | A.            |
| September ..  | 7,010                     | 558     | 1,480 | 1.07                  | 1.19  | A.            |
| October ...   | 17,400                    | 334     | 2,160 | 1.57                  | 1.81  | A.            |
| November ..   | 3,810                     | 705     | 1,200 | .870                  | .97   | A.            |
| December b    | 5,830                     | .....   | 1,130 | .819                  | .94   | C.            |
| The year..    | 17,400                    | .....   | 2,890 | 2.10                  | 28.17   |               |

a Ice conditions January 3 to 23, 1904, and January 27 to March 3, 1905; discharge estimated.

b Ice conditions December 10 to 13 and 18 to 31, 1909; discharge estimated.

The value of such data in estimating the available water power of any stream can hardly be overestimated; hence, the elaborate results obtained at this gaging station are republished in full, since they give invaluable information regarding one of Monongalia county's greatest and most economic resources.

What appears to be an old, abandoned channel of Cheat occurs a mile and a third north of the Ice's Ferry bridge, where the river seems to have made a loop to the northward around the dome-shaped hill and later cut through the neck of the peninsula thus formed.

Remnants of the old shore line of an ancient lake formed during glacial time in the shape of rounded boulders and gravel in profusion occur along the valley walls of Cheat in Monongalia, at elevations ranging from 950' to over 1000' A. T. One place in particular is along the hill road on the west bank of the river, leading south and westward from the Ice's Ferry bridge. These terrace boulder deposits were made while the Glacial Ice movement blocked the northward course of the Monongahela across Ohio to the St. Lawrence basin.

**Dunkard Creek.**—Dunkard creek drains the larger portion of Battelle and Clay districts, Monongalia county, and empties into the Monongahela 3 miles northward from the State line. The total area of its drainage basin, and of that portion included in Monongalia, are given in the table on a preceding page of this chapter. It has its head in the extreme northwestern corner of the latter county, and flows eastward with a widely meandering channel in its lower course via Jollytown, Brave, Blacksville, Mt. Morris and Dunkard. The table on page 43, gives some interesting data concerning the rate of fall in different parts of its channel. It shows that the rate is much lower in the 20.4 miles of its course between Shamrock and Mt. Morris, than in the lower 12.2 miles of its course between Mt. Morris and the river. This exceptional feature is due to the youthful character of the stream below its pre-glacial terrace and also to the hardness of the strata brought to the surface by the sharp dip to the northwest in the latter part of its course. It evidently possesses its mature character, as exhibited by its widely meandering channel,

by inheritance, since it has yet a large amount of erosion to accomplish to attain base level with the Monongahela.

**Deckers Creek.**---Deckers creek drains much the greater portion of Morgan district, Monongalia county, and empties into the Monongahela at Morgantown. The area of its drainage basin is 63.8 miles (map measurement). It has its head in central Preston county, at an elevation of over 2000' A. T., and flows northwestward, falling to 793.4' A. T., at Morgantown. The table on a preceding page of this chapter gives some interesting data concerning the rate of fall in different parts of its course. It is the writer's belief that Cobun creek once flowed into Deckers creek via Aaron creek through the low gap located just east of Kingwood pike, about a mile and a half southeastward from the mouth of the former. Later the advancing headwaters of a stream occupying the present lower course of Cobun finally captured the latter creek. Still another noteworthy topographic feature is connected with Cobun creek near its mouth where it has cut through the neck of the peninsula formed by one of its loops to the west, and left standing an isolated and dome-shaped hill.

**Buffalo Creek.**---Buffalo creek has its head in the extreme northwestern corner of Marion county at an elevation of 1300' A. T., and flows southeastward, emptying into the Monongahela river one mile below Fairmont. It drains the larger portion of Mannington, Lincoln and Fairmont districts, and the area of its drainage basin is 125 square miles. The table on a preceding page of this chapter gives interesting data on the rate of fall in different parts of its course. It shows that this stream is still in the period of youth, and that its mature character, as exhibited by its widely meandering channel below Mannington, is one of inheritance from pre-glacial times.

Between Mannington and Downs there occurs what seems to be an old abandoned channel of this creek, part of which is at present occupied by Mahan run in the last half mile of its course. Here, Buffalo evidently once made a loop to the northward around the dome-shaped hill and later cut its present channel through the neck of the peninsula formed.

What appears to be a typical case of stream piracy ap-



pears to have occurred three-fourths mile southward from Downs. It seems quite probable that Grays run once emptied into Buffalo almost a mile further down stream through the low gap 0.6 mile southeast of Downs station, but was later beheaded by the ever advancing divide of a stream, the channel of which is now used by Grays run in the last half mile of its course.

**Threeforks Creek.**—Threeforks creek empties into Tygart Valley river at Grafton, and drains a large part of the eastern half of Taylor county. It has its head near the summit of Chestnut Ridge in Clinton district, Monongalia county, 3 miles eastward from Ridgedale, and flows south and westward via Irondale and Thornton. The area of its drainage basin is 103 square miles (map measurement). The table on a preceding page of this chapter gives interesting data as to the rate of fall in different parts of its course. The results therein expressed show that it is still in the period of youth, that a great work of erosion remains yet to be accomplished before it attains base level with Tygart Valley river.

### TOPOGRAPHY OF THE LAND AREA.

The topography of the Monongalia-Marion-Taylor area, as with other counties in the western portion of the State, is that of a highly dissected plateau, ranging in elevation from 1500 to over 2000 feet above sea level. Erosive agents have reduced this plateau practically all to slope, the streams generally flowing in narrow, deeply indented "V" shaped valleys, with comparatively sharp and narrow divides between. The several ridges and knobs therein, capped with more resistant layers of hard strata, remain as mute testimony of this plateau's former existence.

The Monongahela river and its large tributaries—Cheat, Tygart Valley and West Fork rivers—have eroded deep gorges in this plateau from  $\frac{1}{4}$  to  $\frac{3}{4}$  mile in width and from 600 to 1350 feet in depth, through nearly horizontal and parallel layers of rock. The valley walls are often quite precipitous.

and especially is this true in the great gorge of Cheat river from Ice's Ferry bridge southeastward to the Preston county line.

### *River and Lake Terraces.*

As mentioned on a preceding page, there occur a series of high erosion terraces along the valley walls of the Monongahela river and its large tributaries—Cheat, West Fork and Tygart Valley—in the three counties under discussion. The **first terrace** comes 30 to 40 feet above the river at Morgantown, at an elevation of about 830' A. T.; the **second**, 75 to 80 feet above the river, at about 875' A. T.; the **third**, 125 to 175 feet above the river, at about 920' to 970' A. T.; the **fourth**, about 200 feet above the river, at about 1000' A. T.; and the **fifth**, 275 to 300 feet above the river, at about 1070' to 1100' A. T.

The latter represents the highest level reached by the ancient Lake Monongahela of glacial time, the lower terraces its successive stages, resulting from the spasmodic lowering of the outlet from the great ice and glacial drift dam impounding its waters.

I. C. White gives the following interesting paper, published on pages 368-379 of Vol. XVIII of "The American Geologist," dated August, 1896, on these high terraces and their deposits along the Monongahela:

### **Origin of the High Terrace Deposits of the Monongahela River.**

"At the Minneapolis meeting of the A. A. A. S., in 1883, the writer presented a paper before Section E in explanation of the terrace deposits along the Monongahela river, as well as those along the old and abandoned Teazes valley, which extends from the Great Kanawha at St. Albans, along the C. & O. R. R. to the Ohio river at Guyandotte.

"In that paper the origin of these deposits was referred to the hypothetical glacial dam in the region of Cincinnati, evidence for the existence of which had just been published by Prof. G. F. Wright, of Oberlin, Ohio.

"Continued studies of the river between the Great Kanawha and the Monongahela have still led the writer to refer the terrace deposits of the latter river to a glacial dam, but not to the one which Prof. Wright believes existed at Cincinnati.

"It is now pretty surely established, through the work of Carll, Spencer, Hice, Foshay, Chamberlin, Leverett, and others, that the

Monongahela, lower Allegheny, and upper Ohio waters drained northward into the Lake Erie basin in pre-glacial time. The great ice-field which covered northern Ohio and Pennsylvania, and descended southward nearly to the Ohio river at Rochester, or Beaver, Pa., would, of course, effectually stop the northward drainage of this pre-glacial river, and impound the accumulating water into a vast lake-like reservoir, until it filled up to the level of any divides that might lead the surplus water across them to other drainage channels.

"If any such old outlets exist, they would furnish almost a demonstration of the reality of this supposed glacial lake, which I have named Lake Monongahela. The writer has often called the attention of geologists to a remarkable old gap in the divide which now separates the Ohio and Monongahela waters, at the head of the latter stream, just west of Salem on the Baltimore and Ohio Southwestern R. R., thirty-six miles west from Grafton. It is a valley 300 to 400 feet wide, filled with clay deposits, and separating Ten Mile creek, on the Monongahela side, from Middle Island creek waters of the Ohio drainage. The summit of this coll, one mile west of Salem, is 1,102 feet, A. T., while the bottom of the cut through it on the railroad or bed-rock under the clay-covered summit, is 1,081 feet, A. T.

"At the head of Rock Camp creek, another tributary of Ten Mile creek, which heads several miles (8 to 10 miles) north of Salem, there is another gap through the divide at exactly 1,143 feet, A. T., as determined by an experimental R. R. survey. Also, Prof. T. M. Jackson informs me that there is a third gap through the same divide, one mile north from the one on the Baltimore & Ohio R. R., and through this the North West turnpike passes.

"The general elevation of the divide which separates the waters of Ten Mile and Middle Island creeks is 1,400 feet to 1,500 feet, A. T. Here, then, are three gashes or wiers cut down 300 feet below the general level into valleys of considerable breadth from whose level summits the waters now go in opposite directions.

"The escape of the impounded water of Lake Monongahela would sufficiently account for these old channels or colls. Curiously enough, there is another outlet at this same level (1,100' A. T.) near the headwaters of the West Fork of the Monongahela, since the wide level summit at Arnold's, on the West Virginia and Pittsburgh R. R., is 1,095 feet A. T., and the railroad is cut five to six feet below the level stretch of land which makes the divide between the Monongahela and Little Kanawha waters. This 1,100 foot divide at three or four different outlets from Lake Monongahela, could hardly be a coincidence merely, but must represent the old colls through which the surplus water of the imprisoned rivers escaped to lower levels during glacial times.

"We thus have at hand an explanation of the immense deposits of stratified silts, clays, boulder beds, and other trash found at the junction of streams all along the Monongahela river, and especially above the level of the upper slopes of the river gorge, beginning at one hundred to one hundred and fifty feet above the present river.

"A large stream, Deckers creek, joins the Monongahela at Morgantown, coming in from the east after cutting through Chestnut ridge and draining a large mountain area east from the latter. At its junction with the Monongahela it has dumped large deposits of sand, boulders, and clay, which after much erosion still retain, in favorable localities a depth of seventy feet. From this fact, and also because these deposits were first studied there I have named them the Morgantown beds, confining the name to the deposits which rest on the pre-glacial

rock floor of the river. These beds, which are often as distinctly stratified as the underlying Coal Measure rocks, can be found wherever any shelf of the ancient rock-floor of the river has been preserved, from the head of the Monongahela to Pittsburgh, and on northwestward along the Ohio, and up the Beaver until they are met and submerged by the vast deposits of the terminal moraine. About one mile north from Morgantown, and near the Flats school-house, these beds contain beautifully preserved fossil plants imbedded in a bluish gray pottery clay of impalpable fineness. The plant bed lies at an elevation of 240 feet above the present river, or about 1,030 feet A. T.

"The small collection that I made of these plants and deposited in the West Virginia University, several years ago, together with collections made at different times by Prof. S. B. Brown, of the University, and also some collected by Mr. Walter Hough, of the National Museum, were all sent to Dr. F. H. Knowlton, the accomplished paleobotanist of the U. S. National Museum, Washington, D. C., for identification. Under date of Sept. 17th, 1895, Dr. Knowlton sent me the following account of these fossils:

**Report on a Collection of Fossil Plants from Morgantown,  
West Virginia.**

By F. H. Knowlton, Ph.D.

"Some years ago I was informed by Dr. Walter Hough of the U. S. National Museum of the existence of finely preserved fossil leaves in the vicinity of Morgantown, W. Va. A few small fragments were brought to the Museum by Dr. Hough, but it was not until 1894 that a collection of any magnitude was obtained. These proved to be of so much interest that the collection in the West Virginia University has also, by the kindness of S. B. Brown, professor of geology, been placed at my disposal. This material has all been made use of in the following examination:

"The study of these plants has not been quite completed, but enough has been done to transmit the following presentation. A few well preserved examples appear to be new to science or at least not readily identifiable with known forms.

"Thus far ten forms have been determined with much certainty as follows:

1. *Esquisetum arvense* L.

A small fragment of a sterile branch.

This species is distributed from Virginia to California and northward to Greenland, and is also found in Europe. It is very abundant and attains perhaps its maximum development in New England.

2. *Cyperus* sp.

There are a number of stems that belong evidently to some cyperaceous plant, but they are too fragmentary to be determined.

3. *Potamogeton robbinsii* Oakes.

There are a great number of fragments of stems and leaves of this species, all so well preserved as to leave no doubt as to the correctness of their identification. Its present distribution is from New Brunswick to New Jersey, north of Lake Superior and northward.

4. *Liquidambar styracifolia* L.

A number of fruiting heads and leaves are referred to this species. Its present distribution is from Connecticut and Illinois to Florida and Texas.

5. *Platanus occidentalis* L. Sycamore.

Several fruiting heads are referred to this species. It is found from Maine to Vermont, south.

6. *Ulmus racemosa* Thomas. The White Elm.

A well preserved leaf is referred to this species. It is now found from Ontario and Vermont to Missouri and Kentucky. It is nowhere very common, but is most abundant at the north.

7. *Quercus falcata* Mich.

Two finely preserved leaves of this species. It is found from Long Island to Florida.

8. *Betula nigra* L. Black Birch.

There are several leaves of this species all perfectly preserved. The tree is now distributed from Massachusetts to Florida.

9. *Fagus ferruginea* Ait. Beech.

A large number of well preserved leaves are referred without hesitation to this species. It is a common tree from Nova Scotia to Florida and west.

10. *Castanea pumila* Mill. Chinquapin.

A single leaf only is referred to this form. It now grows commonly from Pennsylvania to Florida and west to Indiana and Texas.

The species thus far determined all belong to living species. Some of them enjoy a wide distribution and are still found growing in the region, while others are now only found to the north. One in particular *Potamogeton robbinsii*, is confined to the north.

It seems probable from the evidence of the plants that they were pushed down from the north during the ice invasion and were entombed, while the species has retreated again to the colder area."

"The occurrence of *Potamogeton robbinsii* in these beds is of special interest, since it practically demonstrates that there was during Glacial times a movement of water from the edge of the ice near Beaver, Pa., southward along the Monongahela valley through the escape wiers just described, which brought with it this northern plant. It is possible that a systematic search would bring to light many other such northern forms, as well as throw much light upon the slight changes that have taken place in species since the Glacial epoch, because there can be little doubt that these plants were embedded in their present matrix during the Ice age. The particular locality in which the plants occur is near the headwaters of two little streams which rise against each other, and then flowing north, empty into the Monongahela, their mouths being two and one-half miles apart.

"The broad level summit between the heads of the two streams is covered with the clay deposits up to 251 feet above the present river bed, and at one locality (Mr. Baker's well) they have a thickness of 65 feet. The surrounding hills are made up of the soft shales of the Barren or Elk River coal measures, and it is in just such a sheltered bayou back from the main channel of the river that we would expect to find such deposits in Lake Monongahela.

"A fine quality of clay for common blue stoneware, or crockery is always found among these deposits where any considerable stream empties into the Monongahela from the west (soft rock areas), while sand and boulders predominate at the mouths of those streams draining from the east (mountain or sand-rock areas). The celebrated pottery clays of Geneva and Greensboro, Pa., just north from the West Virginia-Pennsylvania line are deposited opposite the mouth of Dunkard creek, a stream entering the Monongahela from the west, and draining quite a large area of Permian shales. Here the following structure is exposed at the clay diggings back of Geneva in descending to the Monongahela river:

|  | Feet. |
|--|-------|
| 1. Rounded boulders, sand, and river trash.....  | 50    |
| 2. Soil, boulders, etc., to top of clay bed..... | 5     |
| 3. Reddish clay, fine, tough.....                | 10    |
| 4. Clay mixed with sand, and brown iron ore..... | 6     |
| 5. Bluish gray clay, fine, tough.....            | 10    |
| 6. Bed-rock to level of Monongahela river.....   | 140   |

"The elevation of low water here is 772' A. T. so that the rock floor of the old river is now 912' A. T.

"The same kind of clay as that at Greensboro and Geneva, and which occurs at 150 feet above the river on the Millan farm, West Morgantown, was analyzed by Dr. De Roode, chemist of the U. S. Agricultural Experiment Station at Morgantown, W. Va., with the following results:

|                     | Per cent. |
|---------------------|-----------|
| Silica .....        | 65.95     |
| Alumina .....       | 20.23     |
| Oxides of iron..... | 3.17      |
| Lime .....          | 0.32      |
| Magnesia .....      | 1.36      |
| Soda .....          | 0.53      |
| Potash .....        | 2.60      |
| Water and loss..... | 5.84      |
| Total .....         | 100.00    |

"At Morgantown, sixteen miles above Geneva, the level of the old rock floor at the head of High street is 916 feet A. T. or 129 feet above river level, and the same at the University buildings, which are situated on top of this old river channel. But on the west side of the river, at Keck's hill, where the deposit is 70 feet thick, the level of the old floor is only 905 feet A. T. This difference between Morgantown and Geneva is to be explained because of the soft shale floor of the old channel at Morgantown, which was eroded deeper than the hard sandstone of the old channel at Geneva.

"At Uffington, three and one-half miles above Morgantown, near the mouth of Booth's creek, we find the level of the old floor on the hard Mahoning sandstone under a large deposit of sand (brought out of the mountains from the east by Booth's creek), at 915 feet A. T., or 125 feet above the present bed.

"Fairmont and Palestine at the junction of the Tygart's Valley and West Fork rivers, 26 miles above Morgantown, are situated on the wide plain excavated by the pre-glacial river, and as might be expected, the old rock floor is covered to a great depth with terrace deposits, consisting of sand, rounded boulders, etc., from Tygart's valley, and pottery clays from the West Fork river. The elevation of the old rock-floor is 972.5 feet A. T., or 122 feet above the present river, while the top of these deposits extends up to 1,067 feet A. T.

"The terrace material at Fairmont has been well exposed along Fairmont avenue, and its stratified condition is well shown. At the Smith & McKinney building the excavation showed the different stratified layers of sand and clay dipping about 10° to the west.

"A layer of clay about eight feet thick, at near 1,000 feet A. T., has long been mined for pottery clay in the Fairmont region. The corresponding bed at Morgantown has an elevation of 945 feet A. T.

"At Clarksburg, thirty miles above Fairmont, the West Fork river is joined by a large tributary, Elk creek, and the two streams

had carved out a wide valley in pre-glacial time, whose rock-floor under the city has an elevation of 986 feet A. T., or about 70 feet above low water (916 feet A. T.) at the junction of Elk and the West Fork rivers. Here a great deposit of clays and quick-sand, twenty-five feet thick, covers all the level surfaces up to 1,020 feet, A. T. There are some layers of rather coarse sand in the deposits, but the clays predominate, and they are found all along the West Fork river, and its tributaries from Fairmont to Clarksburg and on beyond to Weston, thirty miles south, where they extend to only about thirty feet (1,020 feet A. T.) above water level (990 feet, A. T.).

"At Grafton, on the Tygart's Valley river, twenty-two miles above Fairmont, the elevation of the top of the railroad pier in the river is 997 feet and the terrace deposits extend only about twenty-five higher.

"The principal town sites along the Monongahela river from Weston to Pittsburgh, viz: Weston, Clarksburg, Grafton, Monongah, Fairmont, Palatine, Montana, Morgantown, Point Marion, Geneva, Greensboro, Rice's Landing, Fredericktown, Brownsville, Belle Vernon, Charleroi, Monongahela, Elizabeth, McKeesport, Braddock, Homestead, all have their upper and more level portions situated on the ancient floor of the pre-glacial valley. It is this wide and almost level area of deposits stretching from Braddock to the Monongahela, across to the Allegheny river via Homestead, and East Liberty, which forms the principal site of Pittsburgh itself, as well as Allegheny, beyond. Here a remnant of this ancient valley floor is appropriately named Monument hill, rising, as it does, like an island between the present mouth of the Allegheny river and its filled-up and more ancient channel just north of the island. The bed rock under the terrace deposits of Monument hill is now 190 feet above low water, or 890 feet above tide, and the rock floor under the vast terrace deposits at Bellevue, still further down the Ohio river comes at the same elevation, while the summit of the same deposit there as well as in Pittsburgh and Allegheny, has nowhere been observed above 900 feet A. T., or 290 feet above low water in the present rivers.

"This old elevated valley floor can be followed down the Ohio river to Rochester, and up the Beaver river past New Brighton, Beaver Falls, Rock Point, Wampum, Mahoningtown and New Castle, beyond which, up the Shenango, it sinks out of sight under the drift-filled valleys, and at Sharon is submerged by 60 feet of cover, 40 feet below the present water level or 780 feet A. T.

"The exact course of the pre-glacial river from Sharon north-westward to the Lake Erie basin has not yet been clearly delineated, but Mr. Leverett's studies leave little doubt that from Sharon, the course was northwestward through the low drift-filled divide at Warren, O., (now only 900 feet A. T., and its rock floor probably 200 feet lower), and thence northward along the general course of Grand river.

"Just how long Lake Monongahela existed, and drained its surplus waters southward through the Middle Island and Little Kanawha gateways, cannot be estimated except by the deposits just described; but finally the barrier along the upper Ohio, (probably at the 'Narrows' below Moundsville, W. Va., as believed by Profs. Chamberlin and Leverett) gave way, and the level of Lake Monongahela was speedily lowered by the rapid cutting away of the soft rocks along the present Ohio valley. Just how much of Ohio river history dates from this interglacial origin, it is yet impossible to determine, but the character of the topography along the river, everywhere between

Rochester, Pa., and Cincinnati, O., (below which the writer has not studied it), would lead to the conclusion that all this portion of the river is new, and that the conclusions of Prof. Tipton, of Denison University, Granville, O., are well maintained, viz.; that in pre-glacial times the waters of the Muskingum, Scioto, and other rivers of Ohio, all flowed northward into the Lake Erie system.

"This being true, it would follow as a corollary that all of the West Virginia rivers which rise on the western slope of the Allegheny mountain-divide including the Little and Big Kanawhas and the Big Sandy, must have once gone northward in pre-glacial times and joined the Scioto, Muskingum, and other Ohio streams in their northward course, right athwart the present valley of the Ohio, but on a plane probably 200 to 300 feet above the present rock floor of the Ohio. The search for these former high level valleys north from the Ohio, as bisected by it, is reserved for a future chapter, and it is possible that therein may be found an explanation of the old and abandoned high level Teazes valley, which does not admit of the explanation suggested by Prof. William M. Davis, in a recent number of 'Science,' viz.; stream piracy of Coal river by the Great Kanawha, because the old valley in question is filled with transported boulders and gravel that could have come only from the crystalline rocks of the Blue Ridge in Virginia, and hence the Kanawha itself must once have flowed along the Teazes valley, and been captured by another stream which led it northward to the newly cut Ohio valley, at Point Pleasant.

"If the conclusions here inferred could be fully sustained by further study of the Ohio river system, it will be readily perceived that a pre-glacial drainage map of Pennsylvania, Ohio, West Virginia, and Kentucky would bear very little resemblance to a map of the present drainage, for if the Monongahela, Lower and Upper Allegheny once went northward into the Lake Erie basin, there can be no doubt that the Upper Susquehanna also took this northward route to the sea, in pre-glacial times, and that much of its present course through Pennsylvania is new. The resultant modifications which such a change of direction in a great river system must necessarily bring to pre-existing drainage lines, are so varied and amazing even in contemplation, that their study must furnish many problems of surpassing interest to topographers of the modern school, so ably typified by Prof. Davis and his work.

"The following table represents the descent of the ancient Monongahela river toward the lake region for a portion of its course between Weston, W. Va., and Sharon, Pa., as well as the present water levels between the same points, and also the highest levels of the Morgantown beds, where known:

| Miles                  | Present river, A. T. | Ancient river, A. T. | Top of Deposits A. T. |
|------------------------|----------------------|----------------------|-----------------------|
| 0 Weston .....         | 990                  | 1,000                | 1,030                 |
| 40 Clarksburg .....    | 916                  | 986                  | 1,020                 |
| 75 Fairmont .....      | 851                  | 973                  | 1,067                 |
| 101 Morgantown .....   | 787                  | 916                  | 1,038                 |
| 117 Geneva .....       | 772                  | 912                  | 1,022                 |
| 206 Pittsburgh .....   | 700                  | 890                  | 990                   |
| 332 Rochester .....    | 662                  | 865                  | .....                 |
| 237 Beaver Falls ..... | 715                  | 860                  | .....                 |
| 246 Rock Point.....    | 740                  | 840                  | .....                 |
| 257 New Castle.....    | 780                  | 825                  | .....                 |
| 278 Sharon .....       | 840                  | 780                  | .....                 |



"This table shows that while the present river falls 290 feet between Weston and Pittsburgh, the floor of the ancient stream descended only 110 between the same points, or only about one-half foot per mile, which is practically that of a base-leveled valley, or one quite advanced in age, to say the least. The rapid descent of the modern river below the old rock floor of the ancient one gives rise to the steep slopes and gorge-like character of the Monongahela valley everywhere between Weston and Pittsburgh, while the same is true of the lower courses of all the larger tributary streams, the descent in these being very rapid in the last few miles of their courses, while in their upper reaches the slope is gentle and the topography much older looking.

"The smaller streams, which rise only five to ten miles back from the Monongahela, descend to it in the last mile or two of their courses by a series of rapids and cascades, while the still smaller brooks and rivulets have cut mere notches in the bounding valley walls below the level of the ancient rock floor of the Monongahela, so that every feature of the topography tends to confirm the conclusion that the age of the river below the old base-leveled plain shown in the table, has been of comparative short duration, and must be measured by only a few thousand years at most.

"The writer had intended to present a map with this paper, showing in a crude way the pre-glacial drainage of the areas herein described, but so much detailed work must yet be done before any approach to accuracy can be hoped for that the mapping is left for other and more skillful workers in this promising field. In this connection I would call the attention of students of the subject to the former northward course of the Little Beaver and the Slippery Rock.

"The former once went northward along with the Monongahela drainage, but being dammed up by the northern ice it cut a new channel about fifteen miles long, southward into the Ohio river drainage, and this fully accounts for the wonderful change in topography along the lower portion of its course, as well as for the southward transportation of large granite boulders several miles beyond the limits of true glacial movement, thus giving rise to the phenomena called the 'fringe' by Lewis and Wright; for wherever a stream was thus impounded the blocks of ice floating southward across these temporary lakes from the terminus of the glacier would of course bear away and, melting, scatter over the surface many masses of imbedded rock.

"The Slippery Rock now joins the Connoquenessing in a curious manner, by meeting it direct, and the combined stream turns off at right angles to enter the Beaver at Rock Point. In pre-glacial time the Slippery Rock left its present channel a short distance above Kennedy's upper mill, and following the present valley of Big run, turned northwestward near New Castle, and cutting squarely across the present gorge of the Neshannock (which is also of post-glacial origin) passed two and one-half miles north of New Castle and entered the ancient Monongahela near Harbor Bridge. All this is fully attested by the wide drift buried valley, which can be followed from Slippery Rock clear through to the Shenango, and the courses of this ancient stream also confirms the conclusion of Leverett that the pre-glacial drainage took the Shenango route via Sharon instead of the Mahoning, and that the lower portion of the latter stream is of recent origin. The Slippery Rock was turned southward at Kennedy's upper mill by the advancing ice-sheet which filled its pre-glacial valley, and on retreating left a dam of drift 100 feet high

across its former course, while the wild gorge and raging stream between Kennedy's mill and the Connoquenessing, so different from the wide valley and sluggish current above the mill, though the outcropping rocks are the same, fully attest the recent origin of the twenty-mile cut between the mill and the Connoquenessing, near Wirtemberg."

# PART III.

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## The Geology of the Monongalia- Marion-Taylor Area

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### CHAPTER III.

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#### STRUCTURE.

##### Introduction.

Geologic structure treats of the pitch or lay of the stratified rocks. The first position of rock beds whether formed from lava flows or by sedimentation is regularly horizontal. Their original position, however, is later much changed by tangential pressure effected by the contraction of the earth's interior, and the strata composing the crust of the latter are thus bent and warped by this pressure into a number of parallel wrinkles or folds. In the area under discussion these folds all have a northeast-southwest trend. In the discussion of these structural forms on subsequent pages, the upward bending arch is known as an **anticline**; the downward bending trough, a **syncline**; the line joining the highest points of an anticline or the lowest points of a syncline, the **axis of the fold**; the direction of the horizontal edges of dipping strata, the **strike**; and the structural form resulting from the sudden rise or fall of the axis of an anticline the **nose** of the fold.

##### Method of Representing Structure.

There are two methods of representing structure in geologic mapping in general use, both of which have been dis-

cussed in detail by the writer in former county reports of the State Survey. The contour line method has been selected for this report, since no faults occur and the folds with one exception are comparatively low. The Pittsburgh coal bed has been selected as the 'key rock' on which to base the structure, since it is very persistent and widely known in the area both from exploitation by miners, and by drillers for oil and gas. It also crops over a large portion of the three counties.

The elevation of the top of the Pittsburgh coal over a large part of the area was obtained by levels directly on its crop, but in western Monongalia and Marion counties, the horizon of this coal lies deeply buried below drainage, so that its elevation therein had to be determined largely from the logs of oil and gas well borings, diamond drill holes and coal mine shafts that had penetrated the seam, or from its interval below some definitely recognized stratum cropping above, the two most important of which are the Washington and Waynesburg coals. The following table gives accurate measurements for the two latter seams down to the top of the Pittsburgh bed at several points, arranged in alphabetical order in Monongalia and Marion counties. The numbers in parentheses refer to map and tabulated numbers of wells mentioned in text:

**Table Showing Intervals to Top of the Pittsburgh Coal.**

|   | Waynesburg<br>Coal.<br>Feet. | Washington<br>Coal.<br>Feet. |
|---|------------------------------|------------------------------|
| Annabelle (634A), 1.2 miles north of..... | 405                          | ...                          |
| Annabelle (635), 1 mile northeast.....    | ...                          | 560                          |
| Behler (230), 2.3 miles south 80° E.....  | 367                          | ...                          |
| Bingamon (535), 2 miles N 80° W.....      | 385                          | ...                          |
| Blacksville (148), 1.3 mile SW of.....    | 356                          | ...                          |
| Bowlby (250), 1 mile NE of.....           | 368                          | ...                          |
| Bowlby (252), 1.3 miles NW of.....        | 375                          | ...                          |
| Cassville (265), 1 mile NE of.....        | 366                          | ...                          |
| Cassville, (268), 1 mile NW of.....       | 375                          | ...                          |
| Cassville (291), 1.5 miles SE of.....     | 393                          | ...                          |
| Dolls run (297), head of.....             | 361                          | ...                          |
| Fairview (555), 1 mile NE of.....         | 383                          | 558                          |
| Fairview (556), 0.8 mile N of.....        | 375                          | ...                          |
| Georgetown (310), 1.3 miles NW of.....    | 382                          | ...                          |
| Glover Gap (348), 2 miles NW of.....      | ...                          | 509                          |
| Grays Flat (664), 1.2 miles S of.....     | 403                          | ...                          |
| Hagans (232), 0.5 mile east of.....       | 376                          | ...                          |

## STRUCTURE.

|  | Waynesburg<br>Coal.<br>Feet. | Washington<br>Coal.<br>Feet. |
|--|------------------------------|------------------------------|
| Mannington (497), 0.5 mile N of.....     | 381                          | ...                          |
| Mannington (516), 2.5 miles SW of.....   | ...                          | 551                          |
| Mannington (541), 0.5 mile S of.....     | 384                          | ...                          |
| Maple (10), 0.5 mile NE of.....          | 335                          | ...                          |
| Maple (12), 1 mile N of.....             | 325                          | ...                          |
| McClellan (591), 1.5 miles N 10° E of... | 393                          | ...                          |
| McClellan (596), 1 mile SW of.....       | ...                          | 550                          |
| McClellan (599), 1.2 miles SW of.....    | 400                          | 550                          |
| McClellan (612), 1.5 miles SE of.....    | 400                          | ...                          |
| Monongah (658), 2 miles N 10° W of....   | 415                          | ...                          |
| Moorestown (168), 0.4 mile E of.....     | 372                          | ...                          |
| Pleasantville (536), 0.7 mile NE.....    | 375                          | ...                          |
| Ragtown (117), 1.3 miles SW of.....      | 360                          | ...                          |
| Rymer (371), 1.7 miles W of.....         | 311                          | ...                          |
| Underwood (622), 0.6 mile SW of.....     | 410                          | ...                          |
| Wadestown (53), 1.5 miles SW of.....     | 397                          | 522                          |
| Wadestown (80), 1.3 miles SE of.....     | 372                          | ...                          |
| Worley (171), 0.5 miles SW of.....       | ...                          | 532                          |
| Worley (172), 0.6 miles NE of.....       | 340                          | ...                          |

The contour lines show the elevation of the top instead of the base of the Pittsburgh coal, since a large number of the logs obtained from wells in the above mentioned region record only the depth to the top of the coal and omit the thickness. In the eastern portions of the three counties this coal passes into the air above the summits of the highest hills, and there the elevation of its horizon was largely determined from the assumption of the following intervals to well known formations of the Conemaugh, Allegheny and Pottsville series of the Upper Carboniferous:

Table Showing Intervals to Top of Pittsburgh Coal.

| Formation.                                   | Feet. |
|--|-------|
| Clarksburg coal.....                         | 140   |
| Elk Lick coal.....                           | 250   |
| Harlem coal.....                             | 330   |
| Bakerstown coal.....                         | 420   |
| Brush Creek coal.....                        | 540   |
| Upper Freeport coal.....                     | 610   |
| Lower Freeport coal.....                     | 660   |
| Upper Kittanning coal.....                   | 720   |
| Lower Kittanning coal.....                   | 780   |
| Clarion coal.....                            | 830   |
| Homewood sandstone, top of.....              | 840   |
| Homewood sandstone, base of.....             | 880   |
| Tionesta coal.....                           | 880   |
| Upper Mercer coal.....                       | 910   |
| Upper Connoquenessing sandstone, top of....  | 930   |
| Upper Connoquenessing sandstone, base of.... | 1000  |
| Quakertown coal.....                         | 1000  |

On Map II the structure contour lines are printed in green, and these exhibit not only the approximate elevation above sea level of the top of the Pittsburgh coal, but the horizontal contours of the troughs, arches and domes, and the direction of the dip of the strata. A glance at this map will readily show whether or not the coal is above or below drainage at any point in the three counties by noting the elevation of the land surface at the point desired as exhibited by the topographic contours, and the elevation of the coal as shown by the structure contours at the same place. For instance, suppose the position of the Pittsburgh coal was desired at Mannington. The map shows the elevation of Buffalo creek there to be about 960' A. T., and the elevation of the coal as exhibited by the contour lines, about 550' A. T.; hence, the bed should lie about 410 feet below drainage.

As mentioned in preceding county reports, these structure contours are only approximately correct from the assumed fact that over small areas the rocks maintain a uniform thickness, although it has often been established that the interval between two easily determined formations will vary many feet in a short distance. While a large number of elevations were determined with spirit level, much the greater number was obtained with the aneroid barometer checked as frequently as possible on spirit level elevations of the U. S. G. Survey, marked at forks of public highways and other conspicuous places. These checks kept down errors in barometric elevations to the extent that it is believed that over most of the area their sum is less than one contour interval—that is, less than 25 feet, except on the steep slope of the Chestnut Ridge anticline north of the 39° 30' parallel of N Latitude, where the contour interval is 100 feet.

### Detailed Geologic Structure.

The Monongalia-Marion-Taylor area lies along the eastern flank of the great Appalachian Basin or geo-syncline, concerning which a brief account is given by I. C. White on pages 84-85 of Vol. II of the State Geological Reports. Although the three counties lie near the axis and on the eastern

structural slope of this great basin, yet their area is traversed in a northeast-southwest direction by a number of minor folds, the most important of which are as follows:

**Anticlines.**

Amity.  
 Bellevernon (Waynesburg).  
 Wolf Summit.  
 Mooresville (Brownsville).  
 Indiana (Fayette).  
 Chestnut Ridge (Dulany).  
 Hiram.

**Synclines.**

Robinson.  
 Waynesburg.  
 Whiteley.  
 Shinnston.  
 Lambert.  
 Connellsville (Uniontown).  
 Ligonier (Elliottsville).  
 Evansville.

The accurate location and shape of the above folds are exhibited on Map II. A brief description will now be given of these anticlines and synclines in the order listed above.

**Amity Anticline.**—This fold lies between the Robinson and Waynesburg synclines and is no doubt an extension of the Amity anticline of Stone and Clapp<sup>1</sup>, or the Pinhook arch of Stevenson and White. As outlined on Map II, the axis of the anticline enters Monongalia from Greene county, Pa., about one mile west from Jollytown, and bears south 25° to 30° west to its termination near the Monongalia-Wetzel county boundary.

The elevation of the Pittsburgh coal along the crest of the fold varies slightly over 300 feet at the Pennsylvania-West Va. State line to about 175 feet one mile northward from the common corner\* to Monongalia, Marion and Wetzel counties.

**Bellevernon Anticline.**—The Bellevernon anticline of Stone and Clapp<sup>2</sup>, or the Waynesburg of Stevenson<sup>3</sup>, enters Monongalia at Blacksville, and dies out within two miles to the southward. Where the axis of the fold intersects the State line, the Pittsburgh coal has an elevation of almost 400 feet above sea level, but at its southern terminus the coal has dipped down to about 350' A. T.; hence, only the nose of the fold enters the area under discussion.

1. Bull. 304, Oil & Gas Fields of Greene County, Penna., U. S. Geol. Survey, p. 26; 1907.

2. Bull. 304, Oil & Gas, Greene County, Pa., U. S. G. Survey, p. 24; 1907.

3. J. J. Stevenson, Report K, Second Geol. Survey of Penna.; 1876

**Wolf Summit Anticline.**—This fold is one of the most prominent arches of Harrison county, a full description of which is given by the writer on pages 56-58 of the Doddridge-Harrison county report of the State Survey. As outlined on Map II, the axis of this fold enters Marion county from Harrison, one mile southwest of Sturms Mill, bears N. 30° to 35° E., intersecting Tevebaugh creek at Annabelle, and finally dies out west of Farmington (Underwood Sta.) It was thought formerly that this arch extended unbroken to the southern edge of Monongalia, one mile and a half west of McCurdyville, but a glance at Map II will show that the anticline at the latter place is separated from the Wolf Summit arch by the Shinnston syncline, and that the former anticline represents a separate and distinct fold, crossing Buffalo creek one mile and a half east of Farmington.

Where the axis of the Wolf Summit arch crosses the Harrison-Marion line, the Pittsburgh coal has an elevation of about 925' A. T., but the coal dips rapidly northeastward along the nose of the fold, and at Buffalo creek, one mile west of Farmington, has an elevation of slightly less than 700' A. T.

**Mooresville (Brownsville) Anticline.**—The axis of this arch as outlined on Map II, enters Monongalia from Greene county, Pa., a mile and a third northeast of Pentress, bears southwestward, passing one-fourth mile west of Mooresville and 0.8 mile east of Statler Run, intersecting the Monongalia-Marion line, one mile and a half west of McCurdyville. From the latter place it continues its southwest course, crosses Pawpaw creek one mile and a half southeast of Fairview, and at a point one mile northward from Upton suddenly veers to a southeast course for a distance of two miles to again resume its original course, crossing Buffalo creek one mile and a half east of Farmington. From the latter point the axis bears almost due southward, and crosses West Fork river at the east edge of Everson and the Marion-Harrison line a mile and a half westward from Eldora, where it finally dies out on the eastern slope of the Chestnut Ridge anticline, forming the structural terrace upon which occurs the famous "Shinnston Oil Field" of northeastern Harrison county in the vicinity of



Adamsville. The writer has designated it the Mooresville anticline from the town of that name near its crest in northern Monongalia. It appears quite probable that this fold is an extension of the Brownsville anticline of M. R. Campbell<sup>4</sup>, or a minor wrinkle in the large synclinal basin lying between the Bellevernon and Fayette (Indiana) anticlines. The latter party, however, did not outline the axis southwestward beyond Willow Tree. From the latter region it probably veers to the westward as does the axis of the Lambert syncline, to near the head of North branch of Calvin run, and thence to the State line at the point designated above for the Mooresville arch.

Along the axis of this anticline the Pittsburgh coal rises rapidly southward forming a marked nose in the fold, from about 430' A. T. to about 525' A. T. near the head of Long Drain, a mile and a half south of Mooresville, where it flattens somewhat southwestward to the Monongalia-Marion line, the coal having there an elevation of about 740' A. T. It again resumes its rapid southwest rise to a dome-like structure, 2 miles south 30° E. of Fairview where the coal attains an elevation of 750' A. T. From the latter place it dips slightly southward to 720' A. T. at Buffalo creek, and again forms another nose in the fold by rising rapidly southward to an elevation of 900' A. T. at the West Fork river, and 1050' A. T. at the Marion-Harrison line.

**Indiana (Fayette) Anticline.**—The Indiana (Fayette) anticline of Stevenson enters Monongalia from the southwestern point of Fayette county, Pa., bears south 20° to 25° west, and crosses West run 2 miles northwest of Easton and the Monongahela river 0.8 mile north of the mouth of Deckers creek at Morgantown. From the latter point it keeps the same course, following closely the west side of the Monongahela river to near Scrafford, crossing the latter stream 0.5 mile west of Uffington and again at Little Falls to disappear finally a short distance southwest of the latter point on the steep western slope of the Chestnut Ridge anticline. Where the axis of this fold intersects the State line on the east hill side of

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4. Masontown-Uniontown Folio No. 82, U. S. G. Survey; 1902.

the Monongahela river, the Pittsburgh coal has an elevation of 1160' A. T. Southwestward its horizon rises rapidly along the axis, forming a nose to the fold and elevating the same to 1300' A. T. west of Morgantown, 1400' A. T. west of Scraftord, 1450' A. T., 0.5 mile west of Uffington, and about 1480' A. T. at Little Falls.

**Chestnut Ridge Anticline.**—This great arch is by far the most pronounced structural feature in the area under discussion and has been so designated by J. J. Stevenson from a ridge of that name in eastern Monongalia. It has also been called the Laurel Hill Anticline by Rogers<sup>5</sup> and the Dulany anticline by Campbell<sup>6</sup>, and is probably the longest continuous structural fold in the State. Its course southwestward in the latter area has already been outlined by the writer on pages 58 and 59 of the Doddridge-Harrison Report of the State Survey. The axis of the fold enters West Virginia about one mile east of the northeastern corner of Monongalia, bears south 20° to 30° west and intersects the Preston-Monongalia line one mile and six-tenths northwest of Pisgah; Cheat river, one mile and four-tenths northwest of Beaverhole; Deckers creek, 1 mile southeast of Sturgisson; and the Monongalia-Marion county line, 0.4 mile northwest of the common corner to Monongalia, Taylor and Marion counties. From the latter place it veers to an almost west course to a point about two miles east of Hammond, where it resumes its original southwest course, crossing Tygart Valley river 0.6 mile northwest of Valley Falls, Husted creek, a mile and a half north of Meadland, and the Taylor-Harrison county line just north of the Northwestern turnpike. The shape of this fold is exhibited in a graphic manner by the green contour lines on Map II. North of the 39° 30' parallel of North latitude the dip on both flanks of the arch is so rapid that for the sake of clearness only the even hundred-foot contour intervals were given three to four miles down on each side of the crest. Owing to the fact that intervals had to be relied on entirely to get the elevation of the horizon of the Pittsburgh coal in this mountain-

5. Rogers, W. B., *Geology of the Virginias*, p. 369; 1884.

6. Campbell, M. R., *Masontown-Uniontown Folio No. 82, U. S. G. Survey*; 1902.

ous region of rapidly dipping strata, the contours are only approximate. In any case, however, the possible error is likely less than one contour interval—that is, less than 100 feet.

A glance at Map II shows that the axis dips rapidly southwestward to near Cheat river where it apparently flattens for two to three miles, to rise again in the dome-like structure at Decker's creek. From the latter place it dips rapidly along the nose of the fold to a point 3 miles northeast of Valley Falls, where it flattens locally for a distance of two miles. Where the fold enters Monongalia county the Pittsburgh coal horizon has an elevation of about 3500' A. T., and where the arch leaves the area discussed, at the Taylor-Harrison line, the same horizon is only about 1460' A. T., giving a total fall of 2040 feet in the axis of the anticline within the three counties.

**Hiram Anticline.**—The shape and location of this fold are well exhibited on Map II in the southeastern corner of Taylor county. The arch apparently has its northeastern terminus two miles southwest of Newburg, Preston county, from which place its axis bears south  $15^{\circ}$  to  $20^{\circ}$  west, and intersects the Preston-Taylor line 2.2 miles due north of Eby, and the Taylor-Barbour line 0.5 mile southeast of Hiram postoffice, from which place it has been named by the writer. It is apparently a minor wrinkle or fold in the great Ligonier Basin, separating the latter into two distinct limbs southwestward from Newburg, one of which bears southwestward via Grafton, Taylor county, and the other southward via Evansville, Preston county.

As represented in Taylor county, the Hiram anticline is probably only the nose of a greater fold to the southwest in Barbour. At its northeastern terminus the Pittsburgh coal has an elevation of about 1750' A. T., but its horizon rises rapidly southwestward along the axis to slightly over 2000' A. T. at the latter's intersection with Sandy creek. Just where this fold crosses the Tygart Valley river has not yet been accurately determined.

**Robinson Syncline.**—The Robinson syncline is the deep structural basin lying between the Amity and Wolf Summit

anticlines on the east and the Hundred and Arches Fork anticlines on the west. It was so named by the writer on page 69 of the Marshall-Wetzel-Tyler Report of the State Survey from a town of the same name in southeastern Wetzel county near which it passes. The writer has given a full description of its course across the State on pages 62-63 of the Doddridge-Harrison Report. A glance at Map II shows that the Pittsburgh coal attains a lower elevation—less than 100' A. T.—in this Basin in the southwestern point of Marion county, than at any other portion of the three counties.

As outlined on Map II, the axis of the syncline enters Monongalia from Greene county, Penna., in the extreme northwestern point of Battelle district, bears southeast for 2 miles to near St. Cloud, and then veers to a southwest course, following roughly the Monongalia-Wetzel county line, and crossing the Wetzel-Marion line one-fourth mile east of the Glover Gap railway tunnel; Bartholomew fork a mile and a fifth northwest of Seven Pines; and the Marion-Wetzel line again, on the head of Owen Davy creek, 2 miles southwest of Curtisville. The log of the J. L. Hamilton No. 1 well (360) shows a marked canoe-shaped depression along the axis of the syncline where it crosses Bartholomew.

**Waynesburg Syncline.**—The axis of the Waynesburg syncline of J. J. Stevenson<sup>7</sup> enters Monongalia from Greene county, Pa., a mile and a half northwest of Wise (Wana P. O.), and bears southwestward to a point one mile eastward from Saint Leo, passing just to the east of Wadestown. It then veers to the west and dies out in the Robinson Basin, one mile northwest of the common corner to Monongalia, Marion and Wetzel counties. Its course through Greene county, Pa., is well exhibited by Stone & Clapp on their Plate I accompanying Bull. 304 of the U. S. Geol. Survey.

Where the axis intersects the State line, the Pittsburgh coal has an elevation of about 270' A. T., but the latter bed dips rapidly southwestward along the axis to a point two miles southward from Wadestown, where it suddenly flattens down to the westward to its terminus in the Robinson trough,

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7. Report K, Second Geol. Survey of Pa.; 1876.

the Basin itself widening out to a width of two to three miles.

The sudden convergence of the axes of the Waynesburg and Robinson synclines is due to two causes, viz.: the dying out of the Amity anticline, and the presence one mile southwest of Glover Gap of an anticlinal spur having a northwest-southeast direction, and a length of two to three miles.

**Whiteley Syncline.**—The Whiteley syncline of Stone & Clapp<sup>8</sup> lies between the Bellevernon and Fayette anticlines, but in the area under discussion, the writer shows its position to be between the Bellevernon and Mooresville arches. The axis of the trough enters Monongalia from Greene county, Pa., one mile northwest of Pentress, and bears southwestward 5 miles to the vicinity of Daybrook where it disappears on the western slope of the Mooresville anticline. The trough is quite shallow, especially in the last three miles of its course. Along its axis the Pittsburgh coal has an elevation of about 350' A. T.

The fold is of minor importance in West Virginia, but northeastward it is a prominent structural feature of Greene county, Pa.

**Shinnston Syncline.**—The Shinnston syncline was so designated by the writer<sup>9</sup> from a town of the same name in Harrison county through which it passes. It is a very pronounced trough in the latter area where it lies between the Wolf Summit and Chestnut Ridge anticlines, but in Marion and Monongalia its eastern slopes rise to the crest of the Mooresville arch as shown on Map II. The axis of the basin enters Marion from Harrison county one mile west of the mouth of Bingamon creek, and bears northeastward to an intersection with Buffalo creek at the west edge of Farmington (Underwood Sta.), where it suddenly swerves to the northwest and dies out within two miles around the nose of the Wolf Summit arch.

Along the axis of this Basin at Bingamon creek the Pittsburgh coal has an elevation of about 850' A. T., but northeastward the latter bed dips rapidly to about 700' A. T., 0.5

8. Bull. 304, Oil and Gas, Greene Co., Pa., U. S. G. Survey, p. 24; 1907.

9. Doddridge-Harrison Rept., W. Va., Geol. Survey, pp. 63-65; 1912.

mile northeast of Festus. From the latter point the axis is almost horizontal northward to the Farmington region.

In the description of this trough on page 64 of the Doddridge-Harrison report, the writer erred as to its course north-eastward from Festus, owing to the fact that the structure contours for Marion county had not at that time been worked out. A glance at Map II will show that on Buffalo creek the Shinnston and Lambert synclines are separated by the low Mooresville arch.

**Lambert Syncline.**—What appears to be an extension to the southwest of the Lambert syncline of M. R. Campbell<sup>9</sup> enters Monongalia from Greene county, Pa., 2 miles north about 60° east of Worley. An examination of the structure contour map of Greene county, Pa., by Stone & Clapp of the U. S. G. Survey will show the possibility of the axis of the Lambert Basin's extending southward from Willow Tree to the headwaters of Meadow run, and thence southward to the State line to a connection with the same as outlined by the writer on Map II. In Monongalia it is undoubtedly the first structural basin to the west of the Indiana (Fayette) arch.

On entering the latter county, the axis bears southward to near the head of Pedlar run, where it veers more to the west and intersects the Monongalia-Marion county line just east of McCurdyville. It continues the same course for about 3 miles and then veers to the southeast, intersecting Pawpaw creek near the Federal shaft coal mine of the New England Gas & Coke Co., and Buffalo creek at the No. 7 Shaft mine of the Jamison Coal & Coke Co. Southwestward from the latter point it soon dies out in the vicinity of West Fork river on the western slope of the Chestnut Ridge anticline.

At the intersection of the axis of the trough with the State line, the elevation of the Pittsburgh coal is about 425' A. T. The latter seam rises rapidly along the axis southward from the latter place to the vicinity of Behler, and then flattens down along a structural terrace to the vicinity of McCurdyville where it again rises fairly rapid for a mile and a half, to flatten down to a very shallow basin in the Barrackville re-

<sup>9</sup> Masontown-Uniontown Folio No. 82, U. S. G. Survey; 1902.

gion. A well defined structural terrace intersects this Basin in the Stafford-Hoodsville region, extending northeastward entirely across Monongalia, via Georgetown, Cassville and Bowlby, as can readily be observed on Map II.

**Connellsville (Uniontown) Syncline.**—The structural basin along the western foot of the Chestnut-Laurel ridge was first named the **Connellsville**, but later M. R. Campbell<sup>10</sup> applied the name **Latrobe** to that portion of the trough northeastward from Connellsville, and **Uniontown**, to that portion southwestward from the same place, for the reason that the main Basin is divided into two distinct synclines near Connellsville, abutting against each other with a slight offset. The axis of the latter fold enters Monongalia about one mile southwest of Cheat Haven, bears southwestward via Stewartstown and Easton, and intersects Deckers creek at the Morgantown & Kingwood railroad shops, one mile southeast of Morgantown. From the latter point it continues the same course to Booths creek waters, a mile and a half southeast of Uffington, where it finally dies out, owing to the convergence of the axes of the Indiana and Chestnut Ridge anticlines.

At the lowest point of the Basin on the State line, the Pittsburgh coal has an elevation of 1065' A. T. Southwestward along the axis of the trough the horizon of this bed rises gradually to 1150' A. T. at Easton, and 1200' A. T. near Deckers creek, where the rise increases rapidly, throwing the coal horizon up to about 1340' A. T. at the Morgan-Clinton district line.

Although the Shinnston Basin lies immediately west of the Chestnut Ridge arch in Harrison county, yet a glance at Map II will readily show that this trough represents a separate and distinct basin.

**Ligonier (Elliottsville) Syncline.**—This structural fold lies immediately east of the Chestnut Ridge anticline, and has long been known as the Ligonier Basin. M. R. Campbell of the U. S. G. Survey, in the Masontown-Uniontown Folio No. 82, applied the name Elliottsville to a minor wrinkle in this great general syncline, from a town of that name in southern

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10. Masontown-Uniontown Folio, No. 82, U. S. G. Survey; 1902.

Fayette county, Pa., near which it passes. The axis of this fold crosses the State line into Preston county, W. Va., about three miles northwest of Clifton Mills, bears southwestward, crossing Cheat river about one-half mile below the mouth of Big Sandy creek, passing one mile to the east of Masontown, one-half mile west of Reedsville, and thence to Newburg, where it splits into two separate limbs, one of which veers westward, and crosses the Preston-Taylor county line one mile south of Hardman. From the latter place the axis continues the same general course to Grafton where it changes to a more southerly course, passing one-half mile southeast of Pruntytown, through Wendel and Flemington, and intersecting the Taylor-Barbour county line about two miles east of the common corner of Taylor, Barbour and Harrison.

Where the axis intersects the Taylor-Preston line, the Pittsburgh coal has an elevation of about 1750' A. T. Southwestward along the axis the same coal horizon dips gradually to 1575' A. T. at Grafton. Here the dip increases rapidly and brings the coal down to 1335' A. T. in the Pruntytown region, and 1225' A. T. at Wendel. From the latter point the axis flattens down and brings the same coal down to slightly less than 1200' A. T., 0.5 mile southeast of Flemington, the lowest portion of the Basin in Taylor county. From this locality the coal begins to rise gradually southward and at the Taylor-Barbour line has an elevation of about 1225' A. T.

**Evansville Syncline.**—As mentioned above, the Ligonier Basin splits into two limbs at Newburg, Preston county. The writer has given the name Evansville to the limb bearing southward via Evansville and Dent. A glance at Map II will show that the two limbs are separated by the nose of the Hiram anticline. Although this syncline is located entirely without the three counties under discussion, yet its axis and configuration are given on Map II in order to show the split in the general basin at Newburg.



# CHAPTER IV.

## STRATIGRAPHY—GENERAL SECTIONS.

### Introduction.

Geologists have classified the sedimentary or stratified rocks of the earth's surface into divisions based mostly on the animal and vegetable life of the past ages as preserved in a fossil state in the rocks themselves. The following are the principal divisions of the rock column as now generally recognized:

**Cenozoic**—Recent life forms.

**Mesozoic**—Less recent life forms

**Paleozoic**—Oldest forms of life.

**Archean**—Generally crystalline rocks without fossils, and direct evidence of life largely destroyed.

The cropping rocks in West Virginia are mostly included in the Paleozoic division, and by far the greater portion of the surface of the State is covered with rocks belonging to one subdivision of this era, viz., the Carboniferous.

The subdivisions or ages of the Paleozoic are:

|                      |       |                                     |
|----------------------|-------|-------------------------------------|
| <b>Carboniferous</b> | Upper | Permian, or Permo-Carboniferous.    |
|                      |       | Coal Measures, or Pennsylvanian.    |
|                      | Lower | Subcarboniferous, or Mississippian. |

**Devonian.**

**Silurian.**

**Ordovician.**

**Cambrian.**

In the three counties under discussion, the cropping rocks belong almost wholly in the Carboniferous, and include the topmost beds of the Dunkard down to the Berea Grit at the very base of the Subcarboniferous, or Mississippian. Where

the Chestnut Ridge Arch crosses Cheat river in eastern Monongalia, probably 50 to 100 feet of the top of the Devonian crops along both banks of the stream. The following exhibits the several subdivisions of the stratified rocks in northern West Virginia:

**Upper Carboniferous (2300 to 2800 feet):**

- Dunkard, or Permo-Carboniferous Series (1100 to 1200 feet).
- Monongahela Series (260 to 400 feet).
- Conemaugh Series (500 to 600 feet).
- Allegheny Series (225 to 350 feet).
- Pottsville Series (250 to 300 feet).

**Lower Carboniferous (450 to 1000 feet):**

- Mauch Chunk Shales (40 to 250 feet).
- Greenbrier Limestone (15 to 150 feet).
- Pocono Sandstones (400 to 600 feet).

**Devonian (Only about 100 feet of the top crops in Monongalia-Marion-Taylor Area):**

- Catskill Sandstones (Venango Oil Group, 300 to 500 feet).
- Chemung and Hamilton Shales, penetrated in Wheeling deep well to a depth of nearly 2000 feet below the Venango Oil Sand Group without reaching the Carboniferous limestone which probably lies over 6000 feet below the Pittsburgh coal in even the most western portions of this area, and several thousand feet more in the most eastern portion.

In order to illustrate the succession and character of the several formations of the rock column in the Monongalia-Marion-Taylor area, several sections will be given that have been made both from exposure at crop, and from the logs of numerous borings for coal, petroleum and natural gas throughout the three counties.

**MONONGALIA COUNTY SECTIONS.**

**BATTELLE DISTRICT.**—The following section was obtained in the northwest corner of Battelle district by combining a hand-leveled section, measured from the summit of Honsocker Knob near St. Cloud eastward along the ridge and hill road, with the log of the James L. White No. 1 well (7), located on Brushy fork, one mile eastward from St. Cloud. A portion of the section was measured down the hill road leading northeast to the S. L. Spragg No. 1 well (4). The log is as furnished James L. White by a driller on well:

## Section Near St. Cloud, Battelle District.

| <i>Upper Carboniferous (2504')</i>                                     |      | Thickness. | Total. |      |
|--|------|------------|--------|------|
| <b>Dunkard Series (1066')</b>  |      | Feet.      | Feet.  |      |
| <b>Sandstone, flaggy, from top Honsocket</b>                           |      |            |        |      |
| Knob, Upper Proctor.....   | 37   | 37         |        |      |
| Concealed along bench.....   | 7    | 44         |        |      |
| <b>Sandstone, forming bluff, Middle Proctor..</b>                      | 20   | 64         |        |      |
| Concealed along bench.....   | 5    | 69         |        |      |
| <b>Sandstone, massive, green, micaceous, Lower Proctor</b>             |      |            |        |      |
| Concealed .....  | 20   | 89         |        |      |
| Shale, reddish and variegated.....                                     | 21   | 110        |        |      |
| <b>Sandstone, massive, St. Cloud.....</b>                              | 5    | 115        |        |      |
| Shale, sandy.....  | 18   | 133        |        |      |
| <b>Coal, slaty, Windy Gap.....</b>                                     | 4.7  | 137.7      |        |      |
| Fire clay and shaly sandstone.....                                     | 0.3  | 138        |        | 138' |
| Shale, sandy.....  | 8    | 146        |        |      |
| Fire clay.....   | 4    | 150        |        |      |
| Shale, red and variegated.....   | 5    | 155        |        |      |
| Concealed to road fork (U. S. G. S. 1466' A. T. on map).....           | 22   | 177        |        |      |
| Shale, sandy.....  | 5    | 182        |        |      |
| <b>Shale, coaly, Gilmore.....</b>                                      | 12.7 | 194.7      |        |      |
| Fire clay shale.....   | 0.3  | 195        |        | 57'  |
| <b>Limestone, gray and hard, weathered yellowish, Gilmore.....</b>     | 0.3  | 195.3      |        |      |
| Shale, gray.....   | 1    | 196.3      |        |      |
| Shale, sandy.....  | 1.7  | 198        |        |      |
| Concealed .....  | 5    | 203        |        |      |
| <b>Sandstone, flaggy and shaly.....</b>                                | 10   | 213        |        |      |
| Shale, red and concealed.....  | 11   | 224        |        |      |
| Shale, red and variegated.....   | 8    | 232        |        |      |
| Concealed .....  | 11   | 243        |        |      |
| Shale, gray.....   | 12   | 255        |        |      |
| <b>Sandstone, massive.....</b>   | 2    | 257        |        |      |
| Shale, red.....  | 26   | 283        |        |      |
| <b>Sandstone, flaggy and shaly.....</b>                                | 4    | 287        |        |      |
| Shale, reddish.....  | 15   | 302        |        |      |
| Shale, limy and gray.....  | 7    | 309        |        |      |
| Limestone, gray and hard.....  | 2    | 311        |        |      |
| Shale, variegated and red.....   | 1    | 312        |        |      |
| Shale, red and silicious.....  | 11   | 323        |        |      |
| <b>Sandstone, Taylor.....</b>  | 5    | 328        |        |      |
| Fire clay shale.....   | 23   | 351        |        |      |
| Shale, buff, sandy.....  | 3    | 354        |        |      |
| Sandstone .....  | 14   | 368        |        |      |
| Concealed .....  | 2    | 370        |        |      |
| <b>Coal, slaty, Nineveh "A".....</b>                                   | 10   | 380        |        | 185' |
| <b>Limestone, shaly and silicious, Lower Rockport</b>                  | 0.2  | 380.2      |        |      |
| Shale, brown and silicious.....  | 8.8  | 389        |        |      |
| Shale, black.....  | 2.8  | 391.8      |        |      |
| Shale, gray and variegated.....  | 0.2  | 392        |        |      |
| <b>Sandstone, shaly, Nineveh, to level Jas. L. White well (7).....</b> | 13   | 405        |        |      |
|  | 19   | 424        |        |      |

|  | Thickness<br>Feet. | Total<br>Feet. |      |
|--|--------------------|----------------|------|
| <b>Jaa. L. White No. 1 Well Log (7).</b>     |                    |                |      |
| Sandstone, not recorded, supplied from crop  | 4                  | 428            |      |
| Coal, Nineveh, not " " " "                   | 1                  | 429            | 49'  |
| Slate, black, " " " "                        | 1                  | 430            |      |
| Fire clay shale " " " "                      | 2                  | 432            |      |
| Limestone, gray and hard, in layers, Nineveh | 5                  | 437            |      |
| Unrecorded                                   | 629                | 1066           | 637' |
| <b>Monongahela Series (350')</b>             |                    |                |      |
| Unrecorded                                   | 183                | 1249           |      |
| Lime   | 64                 | 1313           |      |
| Coal, Mapletown, Sewickley                   | 6                  | 1319           |      |
| Slate  | 89                 | 1408           |      |
| Coal, Pittsburgh                             | 8                  | 1416           | 350' |
| <b>Conemaugh Series (550')</b>               |                    |                |      |
| Unrecorded                                   | 482                | 1898           |      |
| Sand, (I Cow Run) (Buffalo)                  | 20                 | 1918           |      |
| Slate  | 48                 | 1966           | 550' |
| <b>Allegheny Series (259')</b>               |                    |                |      |
| Slate  | 103                | 2069           |      |
| Gas sand (Lower Freeport)                    | 98                 | 2167           |      |
| Slate, black                                 | 10                 | 2177           |      |
| Limestone                                    | 6                  | 2183           |      |
| Slate  | 42                 | 2225           | 259' |
| <b>Pottsville Series (279')</b>              |                    |                |      |
| Sand, Salt? (II Cow Run and Salt)            | 83                 | 2308           |      |
| Break of slate                               | 4                  | 2312           |      |
| Sand, Salt                                   | 22                 | 2334           |      |
| Slate  | 95                 | 2429           |      |
| Sand, Maxton?                                | 25                 | 2454           |      |
| Slate, black                                 | 50                 | 2504           | 279' |
| <i>Lower Carboniferous (779')</i>            |                    |                |      |
| <b>Mauch Chunk Series (128')</b>             |                    |                |      |
| Slate, black                                 | 35                 | 2539           |      |
| Red rock                                     | 46                 | 2585           |      |
| Slate  | 47                 | 2632           | 128' |
| <b>Greenbrier Limestone (74')</b>            |                    |                |      |
| Big Lime                                     | 74                 | 2706           | 74'  |
| <b>Pocono Sandstones (577')</b>              |                    |                |      |
| Sand, open, Big Injun (Keener)               | 58                 | 2764           |      |
| Slate, black                                 | 10                 | 2774           |      |
| Sand, Big Injun                              | 140                | 2914           |      |
| Slate  | 70                 | 2984           |      |
| Sand, Squaw                                  | 40                 | 3024           |      |
| Slate  | 192                | 3216           |      |
| Sand, open, Thirty-foot? (Berea)             | 67                 | 3283           | 577' |
| <i>Devonian (651')</i>                       |                    |                |      |
| <b>Catskill Sandstones (651')</b>            |                    |                |      |
| Slate  | 91                 | 3374           |      |
| Sand, Fifty-foot (Gantz and Fifty-foot)      | 135                | 3509           |      |
| Slate  | 5                  | 3514           |      |
| Red rock                                     | 10                 | 3524           |      |
| Sand, white, (Thirty-foot)                   | 20                 | 3544           |      |
| Slate  | 15                 | 3559           |      |
| Unrecorded                                   | 100                | 3659           | 376' |

|   | Thickness<br>Feet. | Total<br>Feet. |      |
|---|--------------------|----------------|------|
| Sand, Gordon.....   | 12                 | 3671           |      |
| Slate .....   | 29                 | 3700           |      |
| Sand, Fourth.....   | 10                 | 3710           |      |
| Slate and shale..... (202'?)  | 132                | 3842           | 183' |
| Sand, Bayard.....   | 8                  | 3850           |      |
| Unrecorded to bottom.....   | 84                 | 3934           | 92'  |
| (10" casing, 521'; 8¼" casing, 1482'; and 6¾" casing. Abandoned as dry hole.) |                    |                |      |

Owing to a slight rise in the rocks in the direction the hand-leveled portion of the section was measured, 20 to 30 feet will have to be added to the total for the Dunkard series, giving these measures a thickness of about 1090 feet, the maximum obtained for the Monongalia-Marion-Taylor area.

The following section was obtained by using portions of the logs of the Elihu Eddy No. 6 well (81) and the Samuel Eakin No. 1 well (90) in connection with a hand-leveled section measured eastward down the hill road to Crossroads in the eastern part of Battelle district. The three formations at the top were measured with aneroid from the summit of a high knob, located a mile and a third south about 70° east from Crossroads, and the formations below, down to and including the Jollytown coal, from the summit of the high knob 0.4 mile due east of the town. The section is interesting in that three well-known coals of the Dunkard series are noted:

#### Section at Crossroads, Battelle District.

| <i>Upper Carboniferous (1363')</i>  | Thickness. | Total.     |             |
|---|------------|------------|-------------|
| <b>Dunkard Series (988')</b>  | Feet.      | Feet.      |             |
| Concealed with small sandstone boulders from top of high knob.....                    | 10         | 10         |             |
| <b>Sandstone, flaggy, green forms bluff, Lower Proctor .....</b>                      | <b>35</b>  | <b>45</b>  |             |
| Concealed along bench to geologic level of summit of knob 0.4 mile east of Crossroads | 15         | 60         |             |
| Sandstone, massive, not exposed at latter knob .....                                  | 25         | 85         |             |
| <b>Sandstone, massive, green, micaceous, forms bluff, Gilmore.....</b>                | <b>35</b>  | <b>120</b> | <b>120'</b> |
| Concealed .....   | 92         | 212        |             |
| Shale, green .....  | 5          | 217        |             |
| <b>Sandstone, massive, green micaceous, Taylor</b>                                    | <b>32</b>  | <b>249</b> | <b>129'</b> |
| Shale .....   | 5          | 254        |             |
| Concealed .....   | 22         | 276        |             |
| Sandstone, green, broken and shaly.....   | 10         | 286        |             |
| Concealed .....   | 15         | 301        |             |

|  | Thickness<br>Feet. | Total<br>Feet. |                 |
|--|--------------------|----------------|-----------------|
| Sandstone, massive .....   | 10                 | 311            |                 |
| Concealed with reds.....   | 16                 | 327            |                 |
| Limestone, gray and hard, Nineveh.....                               | 1'                 | 328            | 79'             |
| Sandstone, massive, medium grained, green,<br>micaceous, Burton..... | 40                 | 368            |                 |
| Concealed .....  | 32                 | 400            |                 |
| Fire clay shale (Hostetter coal horizon at<br>top) .....             | 10                 | 410            | 82'             |
| Shale, red.....  | 5                  | 415            |                 |
| Sandstone, massive.....  | 19                 | 434            |                 |
| Fire clay shale with iron ore nuggets.....                           | 7                  | 441            |                 |
| Sandstone, shaly, Fish Creek.....                                    | 20                 | 461            |                 |
| Concealed .....  | 5                  | 466            |                 |
| Coal, slaty, Fish Creek.....   | 0.3                | 466.3          | 56.3'           |
| Fire clay shale.....   | 3.7                | 470            |                 |
| Concealed .....  | 7                  | 477            |                 |
| Sandstone, with shale layers, Rush Run....                           | 26                 | 503            |                 |
| Shale, buff, sandy.....  | 10                 | 513            |                 |
| Coal, slaty...0—1 } Dunkard (1120' B-A. T.)                          | 1                  | 514            | 47.7'           |
| Shale, gray...0—5 }  |                    |                |                 |
| Coal .....0—6 }  |                    |                |                 |
| Fire clay shale and sandstone.....                                   | 5                  | 519            |                 |
| Concealed .....  | 5                  | 524            |                 |
| Shale .....  | 5                  | 529            |                 |
| Concealed .....  | 5                  | 534            |                 |
| Sandstone, massive, Jollytown.....                                   | 37                 | 571            |                 |
| Shale .....  | 5                  | 576            |                 |
| Coal .....1'—4" }  |                    |                |                 |
| Shale, gray...0—4 }  | 2                  | 578            | 64'             |
| Coal, slaty. 0—3 }   |                    |                | (1055' B-A. T.) |
| Unrecorded in Elihu Eddy No. 6 Well (81)..                           | 410                | 988            | 410'            |
| <b>Monongahela Series (375')</b>                                     |                    |                |                 |
| Coal, Waynesburg, supplied from Sam'l                                |                    |                |                 |
| Eakin No. 1 well (90).....   | 4                  | 992            |                 |
| Unrecorded in Eddy No. 6 well (81).....                              | 363                | 1355           |                 |
| Coal, Pittsburgh.....  | 8                  | 1363           | 375             |

CLAY DISTRICT.—Clay district, Monongalia county, lies immediately east of and adjoining Battelle district. The outcropping rocks are in the Dunkard and Monongahela series. The following section was obtained by combining the log of the Grant Stephens Diamond Drill Boring (168), located 0.2 mile east of Mooresville, with a section measured by aneroid northwestward along the hill road leading to the well. The log is as published on page 682 of Vol. II (A) of the State Geological Survey reports:

## Mooreville Section, Clay District.

| <i>Upper Carboniferous (1058')</i>                            |      | Thickness. | Total |
|---|------|------------|-------|
| <b>Dunkard Series (675')</b>                                  |      | Feet.      | Feet. |
| Concealed from top knob to road at low gap,                   |      |            |       |
| 0.9 mile SE of Mooreville.....                                | 100  | 100        |       |
| Concealed along road to northwest.....                        | 10   | 110        |       |
| Sandstone, shaly.....   | 29   | 139        |       |
| Shale .....   | 0.7  | 139.7      |       |
| Coal, Fish Creek.....   | 0.3  | 140        | 140'  |
| Fire clay and shale.....                                      | 5    | 145        |       |
| Sandstone .....   | 10   | 155        |       |
| Concealed .....   | 15   | 170        |       |
| Sandstone .....   | 10   | 180        |       |
| Shale, red.....   | 4    | 184        |       |
| Limestone, brecciated, nodular.....                           | 1    | 185        |       |
| Concealed .....   | 10   | 195        |       |
| Shale, buff, with thin sandstones.....                        | 20   | 215        |       |
| Sandstone .....   | 5    | 220        |       |
| Shale, buff, sandy.....                                       | 15   | 235        |       |
| Sandstone, massive, Jollytown.....                            | 34   | 269        |       |
| Fire clay (Jollytown coal horizon).....                       | 1    | 270        | 130'  |
| Concealed .....   | 20   | 290        |       |
| Sandstone, massive, Hundred.....                              | 10   | 300        |       |
| Shale, buff and sandy.....                                    | 10   | 310        |       |
| Concealed .....   | 35   | 345        |       |
| Sandstone, massive.....                                       | 10   | 355        |       |
| Concealed .....   | 10   | 365        |       |
| Shale, red.....   | 15   | 380        |       |
| Sandstone, friable, Upper Marietta.....                       | 20   | 400        |       |
| Concealed .....   | 29   | 429        |       |
| Fire clay (Washington "A" coal horizon)...                    | 1    | 430        | 160'  |
| Shale .....   | 5    | 435        |       |
| Sandstone and shale.....                                      | 5    | 440        |       |
| Sandstone, massive top, shaly bottom, Lower<br>Marietta ..... | 35   | 475        |       |
| Shale .....   | 5    | 480        |       |
| Concealed .....   | 37   | 517        |       |
| Coal, Washington (1010' B-A. T.).....                         | 3    | 520        | 90'   |
| Concealed to top Stephens coal test boring<br>(168) .....     | 50   | 570        |       |
| <b>Grant Stephens Diamond Drill Boring (168)</b>              |      |            |       |
| Surface .....   | 10   | 580        |       |
| Lime .....  | 60   | 640        |       |
| Sandstone, Waynesburg.....                                    | 35   | 675        | 155'  |
| <b>Monongahela Series (382.2')</b>                            |      |            |       |
| Coal, Waynesburg.....   | 2.5  | 677.5      |       |
| Lime .....  | 78.5 | 756        |       |
| Shale, sandy.....   | 24   | 780        |       |
| Lime and shale.....   | 20   | 800        |       |
| Shale, sandy.....   | 10   | 810        |       |
| Lime .....  | 16   | 826        |       |
| Sand .....  | 13   | 839        |       |
| Shale, blue.....  | 2    | 841        |       |
| Lime .....  | 25   | 866        |       |
| Shale, blue.....  | 2    | 868        |       |

|                                 | Thickness<br>Feet. | Total<br>Feet. |       |
|---------------------------------|--------------------|----------------|-------|
| Lime .....                      | 25                 | 893            |       |
| Shale .....                     | 3                  | 896            |       |
| Lime .....                      | 9                  | 905            |       |
| Shale, blue.....                | 8                  | 913            |       |
| Shale .....                     | 4                  | 917            |       |
| Sand, Sewickley.....            | 45                 | 962            |       |
| Shale, sandy.....               | 2                  | 964            |       |
| Coal, Sewickley.....            | 7                  | 971            | 296'  |
| Lime, Sewickley.....            | 42                 | 1013           |       |
| Lime and shale.....             | 6                  | 1019           |       |
| Coal, Redstone.....             | 1                  | 1020           | 49'   |
| Lime, Redstone.....             | 13                 | 1033           |       |
| Shale .....                     | 7                  | 1040           |       |
| Fire clay.....                  | 2                  | 1042           |       |
| Shale, black.....               | 3                  | 1045           |       |
| Shale .....                     | 2.5                | 1047.5         |       |
| Coal, Pittsburgh (9' 9").....   | 9.7                | 1057.2         | 37.2' |
| <b>Conemaugh Series (0.75')</b> |                    |                |       |
| Slate to bottom.....            | 0.75               | 1058           | 0.7'  |

The following section was obtained in the southeast corner of Clay district on the head of Indian creek by combining an aneroid section, measured from the summit of a high knob, 0.2 mile southward from Behler, along the hill road leading down the latter stream, with the log of the D. J. Eddy Diamond Drill Boring (211), the partial record of which was published on pages 128-129 of Vol. II of the State Survey reports. The Washington coal crops 47 feet by hand-level above the well mouth.

### Section One-half Mile South of Behler, Clay District.

|  | Thickness.<br>Feet. | Total<br>Feet. |     |
|--|---------------------|----------------|-----|
| <i>Upper Carboniferous (878.6')</i>          |                     |                |     |
| <b>Dunkard Series (528)</b>                  |                     |                |     |
| Concealed from top of knob.....              | 50                  | 50             |     |
| Shale .....                                  | 5                   | 55             |     |
| Sandstone, massive, Fish Creek.....          | 30                  | 85             |     |
| Shale .....                                  | 4.8                 | 89.5           |     |
| Coal, Fish Creek, (1395' B-A. T.).....       | 0.2                 | 90             | 90' |
| Fire clay shale, typical, Fish Creek.....    | 10                  | 100            |     |
| Concealed .....                              | 54.8                | 154.8          |     |
| Coal, Jollytown.....                         | 0.2                 | 155            | 65' |
| Shale .....                                  | 5                   | 160            |     |
| Sandstone .....                              | 3                   | 163            |     |
| Concealed, red shale and sandstone.....      | 62                  | 225            |     |
| Shale, buff.....                             | 15                  | 240            |     |
| Concealed and shale.....                     | 25                  | 265            |     |
| Sandstone, flaggy.....                       | 2                   | 267            |     |
| Shale, buff reddish, with thin sandstones... | 28                  | 295            |     |
| Concealed .....                              | 57                  | 352            |     |



|   | Thickness<br>Feet. | Total<br>Feet. |        |
|---|--------------------|----------------|--------|
| Coal, Washington (concealed, thickness estimated) ..... | 3                  | 355            | 200'   |
| Concealed (hand-level measurement) to boring (211)..... | 47                 | 402            |        |
| D. J. Eddy Boring Record (311).                         |                    |                |        |
| Unrecorded .....  | 126                | 528            | 173'   |
| <b>Monongahela Series (350.6')</b>                      |                    |                |        |
| Coal .....0' 6" } .....                                 | 7.6                | 535.6          |        |
| Shale .....1 3 } <b>Waynesburg coal</b> .....           |                    |                |        |
| Coal .....5 10 }  |                    |                |        |
| Shale (1' 5") .....                                     | 1.4                | 537            |        |
| Shale with streaks of lime.....                         | 3                  | 540            |        |
| Sand shells.....  | 23                 | 563            |        |
| Limestone, Waynesburg.....                              | 7                  | 570            | 42'    |
| Sand shells.....  | 7                  | 577            |        |
| Sand .....  | 16                 | 593            |        |
| Shale .....   | 6                  | 599            |        |
| Lime .....  | 1                  | 600            |        |
| Sand shells.....  | 9                  | 609            |        |
| Sand .....  | 3                  | 612            |        |
| Sand shells.....  | 9                  | 621            |        |
| Lime .....  | 10.5               | 631.5          |        |
| Sand shells.....  | 13                 | 644.5          |        |
| Lime .....  | 30.5               | 675            |        |
| Shale, blue.....  | 2.5                | 677.5          |        |
| Lime .....  | 14.5               | 692            |        |
| Shale .....   | 5                  | 697            |        |
| Shale, black.....                                       | 1                  | 698            |        |
| Lime .....  | 9                  | 707            |        |
| Sand .....  | 5                  | 712            |        |
| Lime .....  | 14                 | 726            |        |
| Lime shells.....  | 6                  | 732            |        |
| Sand, Sewickley.....                                    | 53.5               | 785.5          |        |
| Coal Sewickley (6' 8").....                             | 6.7                | 792.2          | 222.2' |
| Shale (4' 10").....                                     | 4.8                | 797            |        |
| Lime shells.....  | 2                  | 799            |        |
| Lime ..... 3' 0" } .....                                | 34                 | 833            |        |
| Lime shells... 1 0 }                                    |                    |                |        |
| Lime ..... 8 0 }  |                    |                |        |
| Soft shells... 2 0 }                                    |                    |                |        |
| Shells ..... 2 0 }                                      |                    |                |        |
| Lime .....18 0 }  |                    |                |        |
| Lime shells.....  | 5                  | 838            |        |
| Soft shells.....  | 3                  | 841            | 48.8'  |
| Coal, Redstone.....                                     | 1                  | 842            |        |
| Slate, black.....                                       | 14                 | 856            |        |
| Sand shells.....  | 1                  | 857            |        |
| Lime, Redstone.....                                     | 1                  | 858            |        |
| Blue shale.....   | 7                  | 865            |        |
| Black shale.....  | 4.5                | 869.5          |        |
| Coal, "roof"....1' 6" } .....                           | 9.1                | 818.6          | 37.6'  |
| Coal .....7 7 } (9' 1") Pittsburgh....                  |                    |                |        |

The above section shows the thickness of the Monongahela series in this region to be only 350.6 feet, or 5 feet less

than given (355' 7") in Vol. II above mentioned. The writer thinks that the coal at 89.8 feet from the top represents the Fish Creek bed of the Dunkard series, since it is accompanied by its characteristic fire clay shale. Owing to the rapid rise in the strata in the direction the section was measured, the intervals above the Washington coal are all shorter than they should be, especially between the Fish Creek and Jollytown coals.

CASS DISTRICT.—Cass district lies immediately to the east of Clay, and is bounded on the north by Pennsylvania, and on the east by the Monongahela river. Its outcropping rocks are in the Dunkard, Monongahela and Conemaugh series. D. B. Reger measured the following hand-leveled section from the top of a knob eastward down the river hill at a point 0.2 mile southward from Jimtown (Randall), in the southeast corner of Cass district:

Section at Randall (Jimtown), Cass District.

| <i>Upper Carboniferous (463')</i>                          |                      | Thickness. | Total. |     |
|--|----------------------|------------|--------|-----|
| <b>Monongahela Series (297')</b>                           |                      | Feet.      | Feet.  |     |
| Concealed from top of knob.....                            | 44                   | 44         |        |     |
| Sandstone, flaggy, gray.....                               | 18                   | 62         |        |     |
| Concealed .....  | 9                    | 71         |        |     |
| Slate, black (Lower Uniontown coal horizon)                | 0                    | 71         | 71'    |     |
| Limestone, hard.....                                       | 12                   | 83         |        |     |
| Concealed .....  | 12                   | 95         |        |     |
| Sandstone .....  | 5                    | 100        |        |     |
| Concealed, limestone, and concealed.....                   | 72                   | 172        |        |     |
| Sandstone, gray, flaggy, Sewickley.....                    | 23                   | 195        |        |     |
| Coal, Sewickley, (4' 2").....                              | 4                    | 199        | 128'   |     |
| Concealed .....  | 10                   | 209        |        |     |
| Sandstone, shaly.....                                      | 23                   | 232        |        |     |
| Limestone and concealed.....                               | 29                   | 261        |        |     |
| Coal, good...3' 1½"  | } Redstone coal..... | 6          | 267    | 68' |
| Slate, black...0 0¼  |                      |            |        |     |
| Coal, good ...2 10¼  |                      |            |        |     |
| Limestone, hard, Redstone.....                             | 15                   | 282        |        |     |
| Slate, black.....  | 7                    | 289        |        |     |
| Coal, Pittsburgh .....                                     | 8                    | 297        | 30'    |     |
| <b>Conemaugh Series (166')</b>                             |                      |            |        |     |
| Concealed and limy shale.....                              | 16                   | 313        |        |     |
| Limestone, hard.....                                       | 6                    | 319        |        |     |
| Sandstone, hard, gray, Lower Pittsburgh....                | 20                   | 339        |        |     |
| Shale, limy, with nodules of carbonate of iron at top..... | 15                   | 354        |        |     |
| Shale, dark.....   | 1                    | 355        |        |     |
| Shale, limy.....   | 4                    | 359        |        |     |

|  | Thickness.<br>Feet. | Total.<br>Feet. |     |
|--|---------------------|-----------------|-----|
| Limestone, hard, Upper Pittsburgh.....                                     | 5                   | 364             |     |
| Shale, limy and hard.....  | 12                  | 376             |     |
| Limestone, shaly.....  | 5                   | 381             |     |
| Shale, gray and hard.....  | 6.3                 | 387.3           |     |
| Coal (8"), Little Pittsburgh.....  | 0.7                 | 388             | 91' |
| Sandstone, shaly.....  | 12                  | 400             |     |
| Slate, black.....  | 1                   | 401             |     |
| Limestone, hard, Lower Pittsburgh.....                                     | 1.5                 | 402.5           |     |
| Slate, black.....  | 1.5                 | 404             |     |
| Shale, gray and hard.....  | 5                   | 409             |     |
| Limestone, hard.....   | 3                   | 412             |     |
| Shale, hard, limy.....   | 8                   | 420             |     |
| Shale, dark.....   | 1                   | 421             |     |
| Sandstone, massive, Connellsville.....                                     | 10                  | 431             |     |
| Coal (8" to 12"), Little Clarksburg.....                                   | 1                   | 432             | 44  |
| Limestone, hard, Clarksburg.....   | 12                  | 444             |     |
| Concealed to Pool No. 9 level, river at Jim-<br>town (793.4' L-A. T.)..... | 19                  | 463             | 31' |

The following section was obtained in the southwestern point of Cass district, the most of which is included in the log of the David Henderson No. 1 gas well (269), drilled by the Union Utility Company in November, 1908, and located a mile and a third south 75° to 80° west of Cassville:

### Section 1.3 Miles West of Cassville, Cass District.

|   | Thickness.<br>Feet. | Total.<br>Feet. |      |
|---|---------------------|-----------------|------|
| <i>Upper Carboniferous (2050')</i>              |                     |                 |      |
| <b>Dunkard Series (567')</b>                    |                     |                 |      |
| Concealed from top of knob near district line   | 260                 | 260             | 260' |
| <b>David Henderson No. 1 Well Record (269).</b> |                     |                 |      |
| Surface gravel (conductor).....                 | 18                  | 278             |      |
| Slate .....                                     | 55                  | 333             |      |
| Sand .....                                      | 28                  | 361             |      |
| Slate and shells.....                           | 70                  | 431             |      |
| Lime .....                                      | 8                   | 439             |      |
| Slate .....                                     | 55                  | 494             |      |
| Sand (Waynesburg), (Bluff).....                 | 61                  | 555             |      |
| Slate, (Caseville Plant Shale).....             | 12                  | 567             | 307' |
| <b>Monongahela Series (384')</b>                |                     |                 |      |
| Coal, (Waynesburg).....                         | 5                   | 572             |      |
| Slate and shells.....                           | 16                  | 588             |      |
| Lime .....                                      | 13                  | 601             |      |
| Slate .....                                     | 19                  | 620             |      |
| Lime .....                                      | 23                  | 643             |      |
| Slate and shells.....                           | 18                  | 661             |      |
| Lime .....                                      | 11                  | 672             |      |
| Slate .....                                     | 8                   | 680             |      |
| Lime .....                                      | 12                  | 692             |      |
| Slate .....                                     | 9                   | 701             |      |
| Lime .....                                      | 13                  | 714             |      |

|                                   | Thickness. | Total. |      |
|-----------------------------------|------------|--------|------|
|                                   | Feet.      | Feet.  |      |
| Slate and shells.....             | 26         | 740    |      |
| Lime and sand.....                | 24         | 764    |      |
| Slate .....                       | 18         | 782    |      |
| Lime and sand.....                | 17         | 799    |      |
| Slate .....                       | 20         | 819    |      |
| Lime .....                        | 12         | 831    |      |
| Slate .....                       | 15         | 846    |      |
| Coal, (Sewickley).....            | 6          | 852    | 285' |
| Lime .....                        | 16         | 868    |      |
| Slate .....                       | 17         | 885    |      |
| Lime .....                        | 18         | 903    |      |
| Slate .....                       | 11         | 914    |      |
| Lime .....                        | 17         | 931    |      |
| Limy sand.....                    | 12         | 943    |      |
| Coal, (Pittsburgh).....           | 8          | 951    | 99'  |
| <b>Conemaugh Series (585')</b>    |            |        |      |
| Slate and shells.....             | 28         | 979    |      |
| Coal, (Little Pittsburgh).....    | 4          | 983    |      |
| Lime shells.....                  | 30         | 1013   |      |
| Slate .....                       | 65         | 1078   |      |
| Sand .....                        | 45         | 1123   |      |
| Slate and shells.....             | 90         | 1213   |      |
| Red rock.....                     | 65         | 1278   |      |
| Slate and shells.....             | 70         | 1348   |      |
| Sand and lime.....                | 15         | 1363   |      |
| Slate .....                       | 30         | 1393   |      |
| Red rock.....                     | 55         | 1448   |      |
| Sand, (Buffalo).....              | 43         | 1491   |      |
| Slate .....                       | 45         | 1536   | 585' |
| <b>Allegheny Series (252')</b>    |            |        |      |
| Sand, (Upper Freeport).....       | 60         | 1596   |      |
| Slate .....                       | 12         | 1608   |      |
| Sand .....                        | 23         | 1631   |      |
| Slate and shells.....             | 14         | 1645   |      |
| Sand, (Lower Freeport).....       | 30         | 1675   | 139' |
| Slate .....                       | 57         | 1732   |      |
| Limy sand.....                    | 32         | 1764   |      |
| Slate .....                       | 24         | 1788   | 113' |
| <b>Pottsville Series (271')</b>   |            |        |      |
| Sand .....                        | 12         | 1800   |      |
| Slate .....                       | 6          | 1806   |      |
| Sand .....                        | 145        | 1951   |      |
| Slate .....                       | 13         | 1964   |      |
| Sand .....                        | 40         | 2004   |      |
| Slate and shells.....             | 55         | 2059   | 271' |
| <i>Lower Carboniferous (638')</i> |            |        |      |
| <b>Mauch Chunk Series (117')</b>  |            |        |      |
| Red rock.....                     | 26         | 2085   |      |
| Slate and shells.....             | 37         | 2122   |      |
| Red rock.....                     | 30         | 2152   |      |
| Slate .....                       | 9          | 2161   |      |
| Lime .....                        | 8          | 2169   |      |
| Slate, black.....                 | 7          | 2176   | 117' |
| <b>Greenbrier Limestone (60')</b> |            |        |      |
| Big Lime.....                     | 60         | 2236   | 60'  |

|  | Thickness.<br>Feet. | Total.<br>Feet. |      |
|--|---------------------|-----------------|------|
| <b>Pocono Sandstones (461')</b>              |                     |                 |      |
| Sand, Big Injun (gas at 2010' and 2040').... | 139                 | 2375            |      |
| Slate and shells.....                        | 30                  | 2405            |      |
| Sand, Squaw.....                             | 32                  | 2437            |      |
| Slate .....                                  | 135                 | 2572            |      |
| Sand .....80' } (Berea) .....                | 125                 | 2697            | 461' |
| Limy sand....45 }                            |                     |                 |      |
| <i>Devonian (386')</i>                       |                     |                 |      |
| <b>Catskill Sandstones (839')</b>            |                     |                 |      |
| Slate and shells.....                        | 90                  | 2787            |      |
| Sand, (Gantz).....                           | 60                  | 2847            |      |
| Slate .....                                  | 15                  | 2862            |      |
| Sand, (Fifty-foot).....                      | 40                  | 2902            |      |
| Red rock.....                                | 30                  | 2932            |      |
| (Sand) .....                                 | 40                  | 2972            |      |
| Red rock .....                               | 85                  | 3057            | 360' |
| (Sand), (Gordon).....                        | 40                  | 3097            |      |
| Slate .....                                  | 30                  | 3127            |      |
| (Sand), (Fourth).....                        | 93                  | 3220            |      |
| Red rock.....                                | 70                  | 3290            | 233' |
| Sand, Fifth (gas, 46' in sand).....          | 55                  | 3345            |      |
| Slate .....                                  | 25                  | 3370            |      |
| Slate and shells.....                        | 28                  | 3398            | 98'  |
| Sand, (Bayard or Sixth).....                 | 58                  | 3456            |      |
| Slate .....                                  | 23                  | 3479            |      |
| Sand, (Elizabeth or Seventh).....            | 57                  | 3536            | 138' |
| <b>Chemung (47')</b>                         |                     |                 |      |
| Slate and lime to bottom.....(147?)..        | 47                  | 3583            | 47'  |

GRANT DISTRICT.—Grant district, Monongalia county, lies south of Cass district, and is bounded on the east by the Monongahela river. The outcropping strata therein are included wholly within the Dunkard, Monongahela, Conemaugh and Allegheny series. The Cassville section on a preceding page illustrates the rock succession in the northern portion of the district. In the southern portion, the following hand-leveled section was measured southwestward along the hill road to the Monongahela river at the mouth of Flaggy Meadow run. The intervals above the Elk Lick coal are slightly less than they should be, owing to the rise in the rocks to the southeast:

**Section One Mile Southeast of Beechwood, Grant District.**

| <i>Upper Carboniferous (417')</i>   | Thickness. | Total. |      |
|---|------------|--------|------|
|   | Feet.      | Feet.  |      |
| <b>Monongahela Series (67')</b>   |            |        |      |
| Coal, along hill road.....  | 52         | 52     |      |
| Sandstone, soft, coarse brown, Upper Pitts-                               |            |        |      |
| burgh .....   | 10         | 62     |      |
| Coal, Pittsburgh (thickness concealed).....                               | 5          | 67     | 67'  |
| <b>Conemaugh Series (350')</b>  |            |        |      |
| Concealed .....   | 20         | 87     |      |
| Coal, blossom, Little Pittsburgh.....                                     | 1          | 88     |      |
| Concealed .....   | 57         | 145    |      |
| Shale, buff.....  | 5          | 150    |      |
| Sandstone, coarse, brown and pebbly, Con-                                 |            |        |      |
| nellsville .....  | 35         | 185    | 118' |
| Concealed .....   | 5          | 190    |      |
| Shale, sandy and buff.....  | 7          | 197    |      |
| Sandstone, buff, medium grained, Lower                                    |            |        |      |
| Connellsville .....   | 22         | 219    |      |
| Shale, gray and soft.....   | 6          | 225    |      |
| Shale, red, with limestone nuggets.....                                   | 15         | 240    |      |
| Fire clay shale.....  | 10         | 250    |      |
| Sandstone, shaly, Morgantown.....   | 29         | 279    |      |
| Shale .....   | 0.6        | 279.6  |      |
| Coal (5"), Elk Lick (974' L-A. T.).....                                   | 0.4        | 280    | 95'  |
| Fire clay shale, typical.....   | 8          | 288    |      |
| Concealed .....   | 14         | 302    |      |
| Sandstone, massive, coarse, }<br>gray and pebbly.....10' } <b>Grafton</b> |            |        |      |
| Fire clay, brown and white 5 } <b>Sandstone ..</b>                        | 32         | 334    |      |
| Sandstone, massive, coarse, }<br>gray and pebbly.....17' }                |            |        |      |
| Concealed .....   | 4          | 338    |      |
| Limestone, shaly, silicious, fossil shells,                               |            |        |      |
| Ames .....  | 21         | 359    |      |
| Shale, dark.....  | 4          | 363    |      |
| Coal, Harlem (12" to 14") (890' L-A. T.)....                              | 1          | 364    | 84'  |
| Concealed to river at mouth of Flaggy                                     |            |        |      |
| Meadow run.....   | 53         | 417    | 53'  |

UNION DISTRICT.—Union district occupies that portion of Monongalia county lying east of the river, and adjoining the State of Pennsylvania. The following section was obtained along the northwestern border of the district by combining a spirit-leveled section, measured northward down the hill road to Van Voorhis, with the log of a diamond drill boring at that place, published on pages 590-591 of Vol. II(A) of the State Survey reports. The writer has indicated in parentheses changes in correlation of the coals from that as published in the report above mentioned:

## Section at Van Voorhis, Union district.

| <i>Upper Carboniferous (626' 9")</i>                                  | Thickness. | Total.    |         |
|---|------------|-----------|---------|
| <b>Conemaugh Series (532' 4")</b>                                     | Feet. In.  | Feet. In. |         |
| Sandstone, coarse, brown, large quartz pebbles, Lower Pittsburgh..... | 24 0       | 24 0      |         |
| Coal blossom, Little Pittsburgh (1105' L-A. T.).....                  | 1 0        | 25 0      | 25' 0"  |
| Shale, gray and limy.....   | 10 0       | 35 0      |         |
| Concealed .....   | 15 0       | 50 0      |         |
| Sandstone, massive, Connellsville....                                 | 15 0       | 65 0      |         |
| Concealed .....   | 83 0       | 148 0     |         |
| Sandstone, massive, coarse, Morgantown (top, 982' L-A. T.).....       | 55 0       | 203 0     | 178'    |
| Concealed and shale.....  | 37 6       | 240 6     |         |
| Fire clay.....  | 0 6        | 241 0     |         |
| Shale, gray, limy and concealed.....                                  | 20 0       | 261 0     |         |
| Shale, dark, fossil shells, Ames.....                                 | 10 0       | 271 0     | 68'     |
| Concealed to top Van Voorhis Bore Hole No. 3.....                     | 49 0       | 320 0     | 49'     |
| <b>Bore Hole No. 3 Record (322) (810' L-A. T.).</b>                   |            |           |         |
| Surface .....   | 12 0       | 332 0     |         |
| Soapstone .....   | 8 0        | 340 0     |         |
| Iron ore and shale.....   | 15 0       | 355 0     |         |
| Shale .....   | 35 0       | 390 0     |         |
| Red rock and green shale.....   | 25 0       | 415 0     |         |
| Shale .....   | 7 7        | 422 7     |         |
| Coal, Bakerstown? (Brush Creek)...                                    | 1 1        | 423 8     | 103' 8" |
| Fire clay.....  | 1 3        | 424 11    |         |
| Shale .....   | 9 1        | 434 0     |         |
| Sandy shale.....  | 1 5        | 435 5     |         |
| Sand .....  | 2 10       | 438 3     |         |
| Green sandy shale.....  | 13 6       | 451 9     |         |
| Green shale with lime.....  | 0 11       | 452 8     |         |
| Gray slate.....   | 6 2        | 458 10    |         |
| Shale .....   | 4 8        | 463 6     |         |
| Sandy shale and red rock.....   | 14 3       | 477 9     |         |
| Shale .....   | 1 0        | 478 9     |         |
| Sand, fine.....   | 3 4        | 482 1     |         |
| Shale .....   | 5 8        | 487 9     |         |
| Dark sand shale.....  | 3 2        | 490 11    |         |
| Sandy shale and lime.....   | 4 5        | 495 4     |         |
| Sandy shale.....  | 11 2       | 506 6     |         |
| Sand .....  | 4 3        | 510 9     |         |
| Slate .....   | 4 9        | 515 6     |         |
| Lime, dark.....   | 2 0        | 517 6     |         |
| Sand, fine.....   | 7 4        | 524 10    |         |
| Slate, Uffington.....   | 7 6        | 532 4     | 108' 4" |
| <b>Allegheny Series (94' 5")</b>                                      |            |           |         |
| Coal, Brush Creek? (Upper Freeport)..                                 | 0 5        | 532 9     |         |
| Fire clay.....  | 2 6        | 535 3     |         |
| Shale .....   | 4 1        | 539 4     |         |
| Sandstone, (Upper Freeport).....                                      | 33 8       | 573 0     |         |
| Shale .....   | 4 10       | 577 10    |         |
| Slate .....   | 1 9        | 579 7     |         |
| Shale and fire clay.....  | 13 0       | 592 7     |         |

|  |                    |
|--|--------------------|
| Shale and lime.....                          |                    |
| Slate, gray.....                             |                    |
| Sandstone, gray and blue,<br>Freeport) ..... |                    |
| Shale and lime.....                          |                    |
| Slate, gray.....                             |                    |
| Slate, black.....                            |                    |
| Coal..0' 4"                                  | } Upper Kittanning |
| Bone.0 1                                     |                    |
| Coal..0 5                                    |                    |
| Bone.0 1                                     |                    |
| Coal..2 10                                   |                    |
| Slate to bottom.....                         |                    |

The following section was portion of Union district by measured from the summit of fifths due south of Cheat Havi river hill, with the log of the Fu located at the mouth of Morga ed in January, 1902, by Brooks log is as furnished by the owi siding near the well:

**Section at Mouth of Mor**

|   |  |
|---|--|
| <i>Upper Carboniferous (1253')</i>          |  |
| <b>Monongahela Series (130')</b>            |  |
| Concealed from top of knob,<br>of well..... |  |
| Sandstone, massive, Upper Pi                |  |
| Coal, Pittsburgh.....                       |  |
| <b>Conemaugh Series (602')</b>              |  |
| Concealed mostly.....                       |  |
| Coal, Elk Lick, and concealed               |  |
| Francis Costolo No. 1 Wel                   |  |
| (Elevation of well mouth,                   |  |
| Surface gravel (conductor)..                |  |
| Lime .....                                  |  |
| Coal, (Bakerstown).....                     |  |
| Lime .....                                  |  |
| Slate .....                                 |  |
| Lime .....                                  |  |
| Sand, (Buffalo).....                        |  |
| Coal, (Brush Creek).....                    |  |
| Sand shell.....                             |  |
| Slate (10" casing, 182').....               |  |
| Lime .....                                  |  |
| Slate .....                                 |  |



|   | Thickness.<br>Feet. | Total.<br>Feet. |      |
|---|---------------------|-----------------|------|
| Sand, (gas and water at 205') (Mahoning)...                   | 10                  | 692             |      |
| Red rock.....   | 15                  | 707             |      |
| Slate and shells.....   | 25                  | 732             | 77'  |
| <b>Allegheny Series (239')</b>                                |                     |                 |      |
| Lime, (Upper Freeport).....                                   | 25                  | 757             |      |
| Sand, (water), (Upper Freeport).....                          | 15                  | 772             |      |
| Slate .....   | 27                  | 799             |      |
| Coal, Lower Freeport.....                                     | 8                   | 807             | 70'  |
| Slate .....   | 10                  | 817             |      |
| Lime, Lower Freeport.....                                     | 8                   | 825             |      |
| Slate (8¼" casing, 358').....                                 | 15                  | 840             |      |
| Sand, (Lower Freeport).....                                   | 15                  | 855             |      |
| Coal, Upper Kittanning.....                                   | 3                   | 858             | 51'  |
| Sand, white, (Lower Freeport).....                            | 72                  | 930             |      |
| Slate .....   | 20                  | 950             |      |
| Coal, Clarion.....  | 6                   | 956             | 98'  |
| Slate and shells.....   | 15                  | 971             | 15'  |
| <b>Pottsville Series (282')</b>                               |                     |                 |      |
| Slate and shells.....   | 59                  | 1030            |      |
| Lime .....  | 10                  | 1040            |      |
| Coal, Upper Mercer.....                                       | 3                   | 1043            | 72'  |
| Sand, (Upper Connoquenessing).....                            | 47                  | 1090            |      |
| Lime .....  | 28                  | 1118            |      |
| Sand, Salt (Lower Connoquenessing).....                       | 40                  | 1158            |      |
| Slate .....   | 6                   | 1164            |      |
| Sand .....  | 5                   | 1169            |      |
| Lime .....  | 9                   | 1178            |      |
| Sand, (Sharon).....   | 75                  | 1253            | 210' |
| <i>Lower Carboniferous (782')</i>                             |                     |                 |      |
| <b>Mauch Chunk Series (177')</b>                              |                     |                 |      |
| Slate .....   | 29                  | 1282            |      |
| Lime .....  | 15                  | 1297            |      |
| Red rock.....   | 133                 | 1430            | 177' |
| <b>Greenbrier Limestone (85')</b>                             |                     |                 |      |
| Big Lime.....   | 85                  | 1515            | 85'  |
| <b>Pocono Sandstones (520')</b>                               |                     |                 |      |
| Sand, Big Injun (oil show at 1110'; gas show,<br>1174') ..... | 333                 | 1848            |      |
| Slate .....   | 10                  | 1858            |      |
| Lime .....  | 82                  | 1940            |      |
| Sand, (Berea).....  | 95                  | 2035            | 520' |
| <i>Devonian (949')</i>  |                     |                 |      |
| <b>Catakill Sandstones (845')</b>                             |                     |                 |      |
| Slate .....   | 10                  | 2045            |      |
| Sand and shells.....  | 35                  | 2080            |      |
| Sand, (Gantz).....  | 50                  | 2030            |      |
| Slate .....   | 5                   | 2135            | 100' |
| Sand, Fifty-foot.....   | 55                  | 2190            |      |
| Slate and shells.....   | 80                  | 2270            |      |
| Red sand, (Thirty-foot).....                                  | 35                  | 2305            |      |
| Slate .....   | 28                  | 2333            |      |
| Red sand, (Gordon Stray).....                                 | 40                  | 2373            |      |
| Slate .....   | 24                  | 2397            | 362' |
| Sand, Gordon.....   | 8                   | 2405            |      |
| Red rock.....   | 145                 | 2550            |      |

|   | Thickness. | Total. |      |
|---|------------|--------|------|
|   | Feet.      | Feet.  |      |
| Sand, (Fourth).....                     | 10         | 2560   |      |
| Red rock.....                           | 35         | 2595   | 198' |
| Sand, (Fifth).....                      | 10         | 2605   |      |
| Slate.....                              | 60         | 2665   |      |
| Shells.....                             | 10         | 2675   |      |
| Slate.....                              | 15         | 2690   | 95'  |
| Sand, (Bayard or Sixth) and shells..... | 25         | 2715   |      |
| Slate.....                              | 55         | 2770   |      |
| Slate and shells.....                   | 30         | 2800   |      |
| Slate.....                              | 80         | 2880   | 190' |
| <b>Chemung Series (104')</b>            |            |        |      |
| Lime.....                               | 10         | 2890   |      |
| Slate.....                              | 90         | 2980   |      |
| Lime.....                               | 4          | 2984   | 104' |

The following aneroid section was measured southward down the east hillside of Cheat river to the bed of that stream a short distance above the Mont Chateau Hotel. The thickness of formations and intervals are only approximate, owing to the very rapid dip of the strata to the northwest:

#### Mont Chateau Hotel Section, Union District.

|  | Thickness. | Total. |      |
|--|------------|--------|------|
|  | Feet.      | Feet.  |      |
| <i>Upper Carboniferous (580')</i>  |            |        |      |
| <b>Conemaugh Series (135')</b>   |            |        |      |
| Sandstone, massive, large quartz pebbles,<br>Buffalo.....                              | 60         | 60     |      |
| Concealed, with old clay or iron ore diggings<br>at base.....                          | 10         | 70     |      |
| Concealed (steep bluff) to bench.....  | 65         | 135    | 135' |
| <b>Allegheny Series (240')</b>   |            |        |      |
| Coal, Upper Freeport.....  | 5          | 140    |      |
| Concealed to public road, 0.2 mile north of<br>hotel.....                              | 59.4       | 199.4  |      |
| Coal, (7"), Lower Freeport (1220' L-A. T.)...<br>Concealed.....                        | 0.6        | 200    | 65'  |
|  | 175        | 375    | 175' |
| <b>Pottsville Series (205')</b>  |            |        |      |
| Sandstone, massive, forms vertical cliff,<br>Homewood.....                             | 30         | 405    |      |
| Concealed.....   | 45         | 450    |      |
| Sandstone, massive, pebbly and white, forms<br>great cliff, Upper Connoquenessing..... | 60         | 510    |      |
| Concealed to Cheat river just above Mt.<br>Chateau Hotel.....                          | 70         | 580    | 205' |

The following section was taken from a paper read by I. C. White before the American Philosophical Society on October 20, 1882. It was measured with aneroid in descending order to the river along the right bank of Quarry run, 0.3 mile

southeastward from the Mont Chateau hotel, where the latter stream cuts a fine exposure through the Pottsville measures:

### Quarry Run Section, Union District.

| <i>Upper Carboniferous (187.3')</i>   | Thickness. | Total Intervals. |        |
|---|------------|------------------|--------|
| <b>Pottsville Series (187.3')</b>   | Feet. In.  | Feet. In.        | Feet.  |
| Sandstone, massive, Homewood, top of XII.....   | 25 0       | 25 0             |        |
| Concealed .....   | 40 0       | 65 0             |        |
| Sandstone, very massive, pebbly ( <i>Upper Connoquenessing</i> ).....                     | 75 0       | 140 0            |        |
| Coal .....0' 10" } <i>Quakertown coal</i> ..  | 1 4        | 141 4            | 141.3' |
| Sand .....0 3 }   |            |                  |        |
| Coal .....0 3 }   |            |                  |        |
| Black, slaty shale.....   | 10 0       | 151 4            |        |
| Sandstone, gray, massive.....   | 20 0       | 171 4            |        |
| Shale, with streaks of coal.....  | 1 0        | 172 4            | 31'    |
| Sandstone, grayish white, massive, base of No. XII.....                                   | 15 0       | 187. 4           | 15'    |
| <i>Lower Carboniferous and Devonian (1085')</i>   |            |                  |        |
| <b>Mauch Chunk Series (300')</b>  |            |                  |        |
| Shale, green, containing I. O. (iron ore), top of No. XI.....                             | 20 0       | 207 4            |        |
| Red shale.....  | 10 0       | 217 4            |        |
| Greenish, sandy shale and flaggy sandstone .....  | 60 0       | 277 4            |        |
| Concealed to mouth of old oil well boring (330A).....                                     | 25 0       | 302 4            | 115'   |
| <b>Ley Oil Well Boring Record (330A).</b><br>(Authority, Mr. Ley, Asst. Driller on well). |            |                  |        |
| Flaggy sandstone and shale.....   | 185 0      | 487 4            | 185'   |
| <b>Greenbrier Limestone (85')</b>   |            |                  |        |
| Limestone, Umbral, Mountain, etc..  | 85 0       | 572 4            |        |
| <i>Pocono Sandstones and Catskill Sandstones (700')</i>                                   |            |                  |        |
| Sandstone, Vespertine, No. X (Big Injun, etc.) to bottom of hole.....                     | 700 0      | 1272 4           |        |

It is quite probable that Mr. Ley's memory was faulty in reporting 700 feet of sandstone at the horizon of the Big Injun sand of the oil well drillers, since no such sand mass has ever been reported in the thousands of other wells penetrating this horizon in the State.

Passing southeastward up the Cheat river gorge 2.5 miles to near where the axis of the Chestnut Ridge anticline crosses the latter stream, the following section, as published by I. C. White in the last paper above mentioned, is exposed on the east hillside of Cheat River, nearly opposite "Cheat View" as shown on Maps I and II. The section was measured with aneroid, and slight modifications therein are indicated by the writer in parentheses:

## Section Opposite Cheat View, Union District.

| <i>Upper Carboniferous (185')</i>               |   | Thickness. | Total. |
|---|---|------------|--------|
| <b>Pottsville Series (185')</b>                 |   | Feet.      | Feet.  |
|   | <b>Massive pebbly sandstone (Upper Connoquenessing)</b> .....   | 150        | 150    |
|   | <b>Shale and shaly sandstone, buff</b> .....  | 35         | 185    |
|   |   |            | 185'   |
| <i>Lower Carboniferous (929')</i>               |   |            |        |
| <b>Mauch Chunk Series (299')</b>                |   |            |        |
|   | <b>Shale, greenish and sandy</b> .....  | 30         | 215    |
|   | <b>Sandstone, greenish gray, flaggy</b> .....   | 90         | 305    |
|   | <b>Red and green shale</b> .....  | 12         | 317    |
|   | <b>Sandstone, greenish, massive at top, flaggy and shaly below</b> .....  | 65         | 382    |
|   | <b>Brecciated limestone</b> .....   | 2          | 384    |
|   | <b>Red and green shales</b> .....   | 25         | 409    |
|   | <b>Blue sandy shale, and green flaggy sandstone</b> .....   | 25         | 434    |
|   | <b>Limestone, impure, fossiliferous</b> .....   | 10         | 444    |
|   | <b>Red and green shale and sandstone</b> .....  | 40         | 484    |
|   |   |            | 299'   |
| <b>Greenbrier, "Mountain," Limestone (110')</b> |   |            |        |
|   | <b>Massive limestone in layers 1'-5' thick, sparingly fossiliferous</b> .....   | 25         | 509    |
|   | <b>Shaly limestone and calcareous shale, very fossiliferous, especially rich in <i>Productus</i>, <i>Spirifer</i>, <i>Athyris</i>, <i>Lophophyllum</i> and <i>Crinoidal</i> columns</b> ..... | 5          | 514    |
|   | <b>Limestone, gray, good, few fossils</b> .....   | 45         | 559    |
|   | <b>Shale and limestone</b> .....  | 35         | 594    |
|   |   |            | 110'   |
| <b>Pocono Sandstones (520')</b>                 |   |            |        |
|   | <b>"Siliceous limestone," passing gradually into sandstone below</b> .....  | 30         | 624    |
|   | <b>Sandstone, massive, pebbly, current-bedded, making cliffs (Big Injun)</b> .....  | 100        | 724    |
|   | <b>Concealed</b> .....  | 390        | 1114   |
|   |   |            | 520'   |
| <i>Devonian (85')</i>                           |   |            |        |
| <b>Catskill Sandstones (85')</b>                |   |            |        |
|   | <b>Concealed to level of Cheat river (860' B.A. T.)</b> .....   | 85         | 1199   |
|   |   |            | 85'    |

The thickness of the Pocono sandstones as revealed by the Morgan Run Section on a preceding page is only 520 feet; hence, the writer has placed 85 feet of the concealed interval in the Catskill.

The following hand-leveled section was measured near the southeastern border of Union district northward down the mountain road to Cheat river level at Beaverhole. Owing to the rapid dip of the rocks to the southeast at this point, the thickness of formations and intervals are only approximate, especially in that portion of the section from the base of the Allegheny series down to the top of the Pocono sandstones.

## Beaverhole Section, Valley District, Preston County.

| <i>Upper Carboniferous (1189')</i>                                      |  | Thickness. | Total. |        |
|---|--|------------|--------|--------|
| <b>Allegheny Series (271')</b>  |  | Feet.      | Feet.  |        |
| Concealed from summit of hill road 1 mile<br>S 45° W of Beaverhole..... |  |            |        |        |
|   |  | 40         | 40     |        |
|   | Shale .....  | 5          | 45     |        |
|   | Coal (20"), Lower Freeport (2014' L-A. T.)..   | 1.7        | 46.7   | 46.7'  |
|   | Shale .....  | 5.3        | 52     |        |
|   | Concealed .....  | 25         | 77     |        |
|   | Sandstone, massive, Lower Freeport, upper<br>division .....  | 37         | 114    |        |
|   | Concealed .....  | 15         | 129    |        |
|   | Sandstone, massive, gray, hard, and pebbly,<br>Lower Freeport.....   | 89         | 218    |        |
|   | Concealed .....  | 22         | 240    |        |
|   | Sandstone, massive.....  | 10         | 250    |        |
|   | Shale .....  | 6          | 256    |        |
|   | Coal .....3' 0" } Clarion coal   |            |        |        |
|   | Slate, gray.1 0 } (1800' L-A. T.).....   | 5          | 261    | 214.3' |
|   | Coal .....1 0 }  |            |        |        |
|   | Concealed .....  | 10         | 271    | 10'    |
| <b>Pottsville Series (314')</b>   |  |            |        |        |
|   | Sandstone, massive, Homewood.....  | 40         | 311    |        |
|   | Concealed .....  | 40         | 351    | 90'    |
|   | Sandstone, massive, great cliff rock, Upper<br>Connoquenessing .....                                       | 100        | 451    |        |
|   | Concealed and sandstone.....   | 62         | 513    |        |
|   | Sandstone, gray and white, coarse and peb-<br>bly, Sharon.....   | 62         | 575    | 224'   |
| <i>Lower Carboniferous (676')</i>                                       |  |            |        |        |
| <b>Mauch Chunk Series (226')</b>  |  |            |        |        |
|   | Concealed with sandstone boulders.....   | 42         | 617    |        |
|   | Concealed with brown and green sandstone.  | 104        | 721    |        |
|   | Sandstone, massive, brown, fine grained....  | 21         | 742    |        |
|   | Concealed .....  | 5          | 747    |        |
|   | Sandstone, massive, coarse, gray and white,<br>and pebbly, Maxton.....                                     | 42         | 789    |        |
|   | Concealed to road forks (U. S. G. S.<br>1260' L-A. T.).....  | 12         | 801    | 226'   |
| <b>Greenbrier Limestone (92')</b>                                       |  |            |        |        |
|   | Concealed .....  | 61         | 862    |        |
|   | Limestone, dark gray, "Big Lime".....  | 31         | 893    | 92'    |
| <b>Pocono Sandstones (296') (top, 1168' L-A. T.)..</b>                  |  |            |        |        |
|   | Sandstone, massive, coarse and pebbly, gray<br>and brown, Big Injun.....                                   | 73         | 966    |        |
|   | Concealed .....  | 203        | 1169   |        |
|   | Sandstone, bluish green, flaggy, Upper<br>Squaw, to Cheat river level at Beaverhole<br>(872' L-A. T.)..... | 20         | 1189   | 296'   |

The following section was measured with aneroid by D. B. Reger from the summit of the hill at the residence of Emory Cale, about one mile north 32° east of Rohr, north-

ward down a run leading into Cheat river one mile below Beaverhole. The intervals are slightly less than they should be, owing to the rise of the strata in the direction of the section:

**Section Two Miles North of Rohr, Union District.**

|   | Thickness. | Total. |      |
|---|------------|--------|------|
|   | Feet.      | Feet.  |      |
| <i>Upper Carboniferous (320')</i>   |            |        |      |
| <b>Pottsville Series (320')</b>   |            |        |      |
| Concealed, mostly sandstone, from summit of hill near residence of Emory Cale.....                  | 45         | 45     |      |
| Coal blossom, Tionesta?.....  | ..         | 45     |      |
| Concealed .....   | 60         | 105    |      |
| Sandstone, massive, grayish white, pebbly 95' thick by hand-level), Upper Connoquenessing .....     | 95         | 200    |      |
| Concealed .....   | 120        | 320    | 320' |
| <i>Lower Carboniferous (835')</i>   |            |        |      |
| <b>Mauch Chunk and Greenbrier Limestone (316')</b>  |            |        |      |
| Sandstone, fine grained, flaggy, micaceous..  | 25         | 345    |      |
| Concealed .....   | 225        | 570    |      |
| Limestone, gray and hard (hand-level measurement), Greenbrier.....                                  | 66         | 636    | 316' |
| <b>Pocono Sandstones (519')</b>   |            |        |      |
| Sandstone, Keener (top, 1385' B-A. T.).....   | 25         | 661    |      |
| Shale, red.....   | 4          | 665    |      |
| Sandstone, hard, gray, very limy at top, making with 60 ft. cliff exposure at base, Big Injun ..... | 105        | 770    |      |
| Shale, gray and limy.....   | 20         | 790    |      |
| Sandstone, hard, greenish gray, flaggy, fine grained .....  | 10         | 800    |      |
| Shale, ferriferous.....   | 10         | 810    |      |
| Concealed .....   | 65         | 875    |      |
| Sandstone, massive, hard, gray, medium grained, Squaw.....  | 125        | 1000   | 364' |
| Shale, gray, hard, very silicious, with iron ore nuggets.....                                       | 55         | 1055   |      |
| Sandstone, limy and hard.....   | 10         | 1065   |      |
| Concealed to Cheat river, mouth of run, one mile below Beaver hole (865' B-A. T.).....              | 90         | 1155   | 155' |

The following section was obtained by combining a spirit leveled section measured from the summit of the knob, 0.3 miles due west of Easton, northward, with the log of the Yost Diamond Drill Boring (319) published on pages 587-588 of Vol. II(A) of the State Survey reports. In the writer's judgment, this boring lacked 75 to 80 feet of reaching down to the Upper Freeport coal, as will appear from a study of the next two sections. The identifications in parentheses are corrections and additions in the log as published:

## Section ½ Mile Northwest of Easton, Morgan District.

| <i>Upper Carboniferous (645.8')</i>                     |   | Thickness.              | Total.    |       |
|---|---|-------------------------|-----------|-------|
| <i>Monongahela Series (100')</i>                        |   | Feet. In.               | Feet. In. |       |
| Concealed from top of knob 0.3 mile west of Easton..... |   |                         |           |       |
|   |   | 65 0                    | 65 0      |       |
|   | Sandstone, massive, Upper Pittsburgh              | 25 0                    | 90 0      |       |
|   | Coal, Pittsburgh (Base, 1167' L-A. T.)            | 10 0                    | 100 0     | 100'  |
| <i>Conemaugh Series (545.8')</i>                        |   |                         |           |       |
| Concealed to Yost Diamond Drill Boring .....            |   |                         |           |       |
|   |   | 181 0                   | 281 0     | 181'  |
| Yost Boring Record (319)                                |   |                         |           |       |
| (Elevation of Well mouth, 986' L-A. T.).                |   |                         |           |       |
|   | Surface .....                                     | 10 0                    | 291 0     |       |
|   | Shale .....                                       | 8 0                     | 299 0     |       |
|   | Sandstone, gray (Morgantown).....                 | 25 0                    | 324 0     |       |
|   | Slate .....                                       | 1 6                     | 325 6     |       |
|   | Sandstone .....                                   | 5 0                     | 330 6     |       |
|   | Slate .....                                       | 1 6                     | 332 0     |       |
|   | Shale and limestone .....                         | 4 0                     | 336 0     |       |
|   | Shale .....                                       | 2 0                     | 338 0     |       |
|   | Slate .....                                       | 1 6                     | 339 6     |       |
|   | Coal, (Elk Lick).....                             | 0 8                     | 340 2     | 59.1' |
|   | Fire clay.....                                    | 1 0                     | 341 2     |       |
|   | Shale .....                                       | 25 0                    | 366 2     |       |
|   | Gray slate.....                                   | 15 6                    | 381 8     |       |
|   | Slate .....                                       | 2 0                     | 383 8     |       |
|   | Sandstone .....8' 0"                              | } (Grafton Sandstone).. | 25 4      | 409 0 |
|   | Sandy shale.....5 4                               |                         |           |       |
|   | Sandy slate.....4 0                               |                         |           |       |
|   | Sandstone and coal partings...5 0                 |                         |           |       |
|   | Sandstone .....3 0                                |                         |           |       |
|   | Shale .....6' 0"                                  | } (Ames Shale).....     | 23 6      | 432 6 |
|   | Slate .....11 0                                   |                         |           |       |
|   | Shale .....2 0                                    |                         |           |       |
|   | Slate .....4 6                                    |                         |           |       |
|   | Coal, (Harlem).....                               | 0 6                     | 433 0     | 93.1' |
|   | Fire clay .....                                   | 0 6                     | 433 6     |       |
|   | Sandy slate .....                                 | 5 6                     | 439 0     |       |
|   | Green shale .....                                 | 7 0                     | 446 0     |       |
|   | Dark shale .....                                  | 6 0                     | 452 0     |       |
|   | Sandy shale .....                                 | 8 0                     | 460 0     |       |
|   | Red shale, (Pittsburgh Reds).....                 | 11 0                    | 471 0     |       |
|   | Sandy shale .....                                 | 14 0                    | 485 0     |       |
|   | Green shale .....                                 | 15 0                    | 500 0     |       |
|   | Sand, (Saltsburg).....                            | 15 0                    | 515 0     |       |
|   | Shale .....                                       | 2 0                     | 517 0     |       |
|   | Sandstone .....                                   | 1 6                     | 518 6     |       |
|   | Fire clay, (Bakerstown coal horizon at top) ..... | 6 6                     | 525 0     | 92'   |
|   | Sandstone, coarse (local).....                    | 21 0                    | 546 0     |       |
|   | Dark shale .....                                  | 4 0                     | 550 0     |       |
|   | Green shale .....                                 | 3 0                     | 553 0     |       |
|   | Sandy shale .....                                 | 5 0                     | 558 0     |       |
|   | Sandstone, Mahoning? (Buffalo).....               | 79 0                    | 637 0     |       |

|  | Thickness.<br>Feet. In. | Total.<br>Feet. In. |        |
|--|-------------------------|---------------------|--------|
| Slate, gray, Brush Creek.....                          | 3 0                     | 640 0               |        |
| Coal ..0' 8" } Upper Freeport? (Brush                  |                         |                     |        |
| Slate .0 3 } Creek) .....                              | 1 6                     | 641 6               | 116.5' |
| Coal ..0 7 } .....                                     |                         |                     |        |
| Fire clay .....  | 2 0                     | 643 6               |        |
| Clay and limestone, Upper Freeport?<br>to bottom ..... | 2 4                     | 645 10              | 4.3'   |

Two miles farther down West run, another diamond drill boring (320) was sunk by H. C. Greer on the McClaren farm, the detailed record of which as published on pages 588-589 of the above mentioned report is as follows:

**McClaren Bore Hole Record (320), Morgan District.**

(Elevation of well, 935' B-A. T.).

| <i>Upper Carboniferous (396')</i>   | Thickness.<br>Feet. In. | Total.<br>Feet. In. |        |
|-------------------------------------|-------------------------|---------------------|--------|
| <b>Conemaugh Series (318.6')</b>    |                         |                     |        |
| Surface .....                       | 9 0                     | 9 0                 |        |
| Green shale .....                   | 15 0                    | 24 0                |        |
| Slate .....                         | 14 7                    | 38 7                |        |
| Limestone .....                     | 5 6                     | 44 1                |        |
| Soft clay .....                     | 10 9                    | 54 10               |        |
| Limestone .....                     | 5 5                     | 60 3                |        |
| Lime shale.....                     | 4 4                     | 64 7                |        |
| Red and green shale.....            | 18 6                    | 83 1                |        |
| Green shale.....                    | 15 11                   | 99 10               |        |
| Sandstone .....                     | 6 5                     | 105 5               |        |
| Green shale .....                   | 10 3                    | 115 8               |        |
| Limestone .....                     | 1 8                     | 117 4               |        |
| Dark shale and slate.....           | 8 11                    | 126 3               |        |
| Limestone .....                     | 1 6                     | 127 9               |        |
| Shale and fire clay.....            | 3 10                    | 131 7               |        |
| Slate .....                         | 0 4                     | 131 11              |        |
| Coal, Bakerstown.....               | 1 4                     | 133 3               | 133.2' |
| Clay .....                          | 2 2                     | 135 5               |        |
| Slate and shale.....                | 2 8                     | 138 1               |        |
| Sandstone .....                     | 15 8                    | 153 9               |        |
| Shale .....                         | 9 5                     | 163 2               |        |
| Fire clay .....                     | 2 2                     | 166 4               |        |
| Red and green shale.....            | 2 9                     | 169 1               |        |
| Sandstone .....                     | 1 4                     | 170 5               |        |
| Red and green shale.....            | 3 2                     | 173 7               |        |
| Sand, slate and lime.....           | 8 9                     | 182 4               |        |
| Sandy shale .....                   | 20 1                    | 202 5               |        |
| Slate .....                         | 14 4                    | 216 9               |        |
| Limestone, Brush Creek.....         | 2 0                     | 218 9               |        |
| Sandstone .....                     | 4 3                     | 223 0               |        |
| Sandy slate .....                   | 5 4                     | 228 4               |        |
| Black slate, Brush Creek.....       | 2 6                     | 230 10              |        |
| Coal .....2" } Brush Creek Coal.... |                         |                     |        |
| Slate .....4 } .....                | 1 0                     | 231 10              | 98.6'  |
| Coal .....6 } .....                 |                         |                     |        |



|                                 | Thickness.             |     | Total. |              |              |
|---------------------------------|------------------------|-----|--------|--------------|--------------|
|                                 | Feet.                  | In. | Feet.  | In.          |              |
| Fire clay.....                  | 19                     | 9   | 251    | 7            |              |
| Limestone .....                 | 1                      | 8   | 253    | 3            |              |
| Shale .....                     | 3                      | 2   | 256    | 5            |              |
| Sand and slate.....             | 13                     | 4   | 269    | 9            |              |
| Black shale .....               | 1                      | 3   | 271    | 0            |              |
| Fire clay .....                 | 2                      | 4   | 273    | 4            |              |
| Shale .....                     | 4                      | 6   | 277    | 10           |              |
| Fire clay and shale.....        | 10                     | 6   | 288    | 4            |              |
| Sandstone .....                 | 26                     | 0   | 314    | 4            |              |
| Sandy slates .....              | 1                      | 0   | 315    | 4            |              |
| Slate .....                     | 1                      | 8   | 317    | 0            |              |
| Slate and bone.....             | 0                      | 2   | 317    | 2            |              |
| Fire clay.....                  | 1                      | 2   | 318    | 4            |              |
| Slate .....                     | 0                      | 3   | 318    | 7            |              |
| <b>Allegheny Series (77.4')</b> |                        |     |        | <b>86.8'</b> |              |
| Coal .....10"                   | } Coal, Upper Freeport | 1   | 2      | 319          | 9            |
| Bone ..... 1                    |                        |     |        |              |              |
| Coal ..... 1                    |                        |     |        |              |              |
| Fire clay .....                 | 5                      | 1   | 324    | 10           |              |
| Slate .....                     | 4                      | 0   | 328    | 10           |              |
| Fire clay .....                 | 3                      | 3   | 332    | 1            |              |
| Sandy slate .....               | 33                     | 0   | 365    | 1            |              |
| Sandstone .....                 | 15                     | 5   | 380    | 6            |              |
| Shale and slate.....            | 5                      | 6   | 386    | 0            |              |
| Shale .....                     | 6                      | 0   | 392    | 0            |              |
| Limestone .....                 | 1                      | 0   | 393    | 0            |              |
| Fire clay .....                 | 3                      | 0   | 396    | 0            | <b>77.4'</b> |

A. D. Minney, Driller.

This boring starts 290 feet below the horizon of the Pittsburgh coal; hence, the Bakerstown, Brush Creek and Upper Freeport coals have been correctly identified in Vol. II(A). According to this record, the Yost boring lacked 82 feet of reaching the base of the Conemaugh series.

The following section was obtained for the vicinity of Morgantown by combining a hand-leveled section measured along the steep valley walls on the west side of the river with the log of the Madeira Hotel Water Well (331), the record of which was kindly furnished by Madeira Bros., the owners. In this well the top of the Buffalo sandstone was struck at a depth of 21 feet; hence, that portion of the well record above the top of this stratum is omitted, since the hand-level section extends down to the top of this sandstone. The upper 337 feet of the section, or that portion above the Elk Lick coal, was measured from the summit of the high knob, 0.8 mile due west of Scrafford, northeastward almost on the

strike of the strata, along the hill road via the quarry in what was heretofore supposed to be the true Connellsville sandstone; and that portion from the Elk Lick coal down to the top of the Buffalo sandstone was measured down the steep river hill northward from Lock No. 10. The Elk Lick-Bakerstown coal interval is 1 foot less than in the accurate Sabraton section as published on page 628 of Vol. II(A) of the State Survey reports. The Pittsburgh coal misses the high knobs immediately north and northwest of Lock No. 10. The section shows that the quarry rock near the summit of the hill, northwest of Scrafford, represents the Lower Connellsville sandstone and not the regular Connellsville as described on page 247 of Vol II of the State Survey reports:

**Morgantown Section, Grant and Morgan Districts.**

| Upper Carboniferous (1144')  | Thickness | Total |                      |
|--|-----------|-------|----------------------|
| Monongahela Series (95)  | Feet.     | Feet. |                      |
| Concealed from summit of knob 0.8 mile   |           |       |                      |
| West of Scrafford.....   | 57        | 57    |                      |
| Sandstone, massive, Upper Pittsburgh.....  | 30        | 87    |                      |
| Coal, Pittsburgh .....   | 8         | 95    | 95'                  |
| <b>Conemaugh Series (605.5')</b>   |           |       |                      |
| Concealed and shale.....   | 40        | 135   |                      |
| Coal .....0' 9" } Little Pittsburgh coal...  | 2         | 137   |                      |
| Shale, gray.0 3 }  |           |       |                      |
| Coal .....1 0 }  |           |       |                      |
| Fire clay shale.....   | 8.4       | 145.4 |                      |
| Coal, shaly.....   | 0.1       | 145.5 |                      |
| Fire clay shale.....   | 5.5       | 151   |                      |
| Concealed and gray shale.....  | 26        | 177   |                      |
| Sandstone, massive, coarse, brown and pebbly, at bottom, medium grained top, Connellsville ..... | 52        | 229   | 134'                 |
| Shale .....  | 1         | 230   |                      |
| Concealed (should hold Little Clarksburg coal)   | 19        | 249   |                      |
| Shale .....  | 1         | 250   |                      |
| Sandstone, flaggy, with shale layers .....   | 9.8       |       |                      |
| Shale, bituminous 0.2  |           |       |                      |
| Fire clay shale.. 0.5  |           |       |                      |
| Sandstone, limy, sometimes limestone .....   | 1.3       |       |                      |
| Sandstone, massive, coarse, mottled with peroxide of iron, quarry rock...21.6                    | 23.4      | 283.4 | Lower Connellsville. |

|  | Thickness. | Total. |        |
|--|------------|--------|--------|
|  | Feet.      | Feet.  |        |
| Concealed .....  | 24.6       | 308    |        |
| Shale, reddish, sandy, forms steep bluff<br>(Morgantown sandstone horizon).....  | 26         | 334    |        |
| Concealed and shale.....   | 3          | 337    |        |
| Coal, Elk Lick.....  | 1          | 338    | 54.6'  |
| Fire clay shale.....   | 5          | 343    |        |
| Concealed (should contain Elk Lick lime-<br>stone) .....   | 13         | 356    |        |
| Shale, reddish, sandy.....   | 30         | 386    |        |
| Shale .....  | 3          | 389    |        |
| Limestone, ferriferous, nodular.....   | 1          | 390    |        |
| Shale, red.....  | 10         | 400    |        |
| Sandstone, limy and hard.....  | 1          | 401    |        |
| Shale, buff.....   | 11         | 412    |        |
| Concealed .....  | 16         | 428    |        |
| Limestone, shaly, sillicious, marine fossils<br>prolific, Lower Ames (975' L.A. T.).....   | 9          | 437    |        |
| Coal, Mariem.....  | 1          | 438    | 100'   |
| Concealed, (Mostly along old river terrace).   | 52         | 490    |        |
| Concealed and red shale, (Pittsburgh).....   | 20         | 510    |        |
| Sandstone, massive, greenish, micaceous,<br>Saltsburg .....  | 12         | 522    |        |
| Shale, sandy.....  | 5          | 527    | 89'    |
| Fire clay shale (Bakerstown coal horizon at<br>top) .....  | 5          | 532    |        |
| Shale, weathering reddish, sandy.....  | 10         | 542    |        |
| Limestone, sillicious, hard, Pine Creek.....   | 1          | 543    |        |
| Shale, brown, sandy to top of Buffalo sand-<br>stone .....   | 2          | 545    |        |
| <b>Madeira Hotel Water Well Record (331).</b>  |            |        |        |
| (Except first 21 feet which is included in<br>section above.)  |            |        |        |
| Sandstone, top 21 feet below<br>well mouth, with small<br>stream of water at 35'....53' } (Buffalo).                             | 89         | 634    |        |
| Boulders and shelly rock... 8 }  |            |        |        |
| Sandstone .....28 }  |            |        |        |
| Fire clay or white wash (Brush Creek coal<br>horizon) .....  | 1          | 635    | 108'   |
| Sand rock, heavy, soft, blue.....  | 9          | 644    |        |
| Unrecorded .....   | 7          | 651    |        |
| Sandstone, hard, gray.22' 0" }   |            |        |        |
| Shale, sandy, dark<br>gray .....12 0 }   | 49.5       | 700.5  | 65.5'  |
| Sandstone, fine, very<br>hard, gray .....15 6 }  |            |        |        |
| <b>Allegheny Series (238.5')</b>   |            |        |        |
| Coal and slate, "rider"....5' } (Upper Free-<br>Shale, sandy, dark gray..15 } port Coal..  | 24         | 724.5  |        |
| Coal .....   | 4          |        |        |
| Sandstone, limy streaks..42' } (Upper Free-<br>Sandstone, shaly.....12 } port Sand-<br>Sandstone, hard and gray.23 } stone) .... | 77         | 801.5  |        |
| Coal and slate, Lower Freeport.....  | 0.5        | 802    | 101.5' |

|   | Thickness.<br>Feet.                | Total.<br>Feet. |      |
|---|------------------------------------|-----------------|------|
| Sandstone and gray sandy shale.....30'  | } (Lower Freeport Sandstone) ..... | 75              | 877  |
| Sandstone, gray, soft, shaly..... 7   |                                    |                 |      |
| Sandstone, hard, grayish white....30  |                                    |                 |      |
| Sandstone, limy streaks ..... 8   |                                    |                 |      |
| Shale, gray.....  | 10                                 | 887             |      |
| Shale, dark gray.....   | 17                                 | 904             |      |
| Sandstone, hard, fine gray (Clarion).....   | 20                                 | 924             |      |
| Coal and slate, Clarion.....  | 2                                  | 926             | 124' |
| Shale, sandy, dark gray.....  | 13                                 | 939             | 13'  |
| <b>Pottsville Series (205)</b>  |                                    |                 |      |
| Sandstone, coarse, mixed with slate and coal, possibly cavings, well cased in this sandstone.. 4' | } (Homewood)                       | 39              | 978  |
| Sandstone, coarse, grayish white, water.....14  |                                    |                 |      |
| Shale, sandy and dark gray 8  |                                    |                 |      |
| Sandstone, hard and gray.. 5  |                                    |                 |      |
| Sandstone, hard, dark gray 8  |                                    |                 |      |
| Unrecorded .....  | 16                                 | 994             |      |
| Sandstone, white, hard, pebbly in streaks, solid, Upper Connoquenessing.....                      | 80                                 | 1074            |      |
| Sandstone, dark shaly.....  | 6                                  | 1080            |      |
| Sandstone, coarse gray.....   | 3                                  | 1083            |      |
| Shale, sandy and dark.....  | 9                                  | 1092            |      |
| Sandstone, grayish white, pebbly.....26'  | } Lower Connoquenessing? ..        | 52              | 1144 |
| Sandstone, shaly, dark.10   |                                    |                 |      |
| Sandstone, gray, hard and pebbly to bottom of well.....16   |                                    |                 |      |
|   |                                    |                 | 205  |

The following section was obtained in the north edge of Sabraton by combining the log of the churn drill coal test Bore Hole No. 5 (334) of the American Sheet & Tin Plate Co., located a few hundred feet northward from the M. & K. R. R. shops near the trolley car line trestle, with a section measured from the summit of the hill one-half mile northeast of the State Farm residence, southward to the mouth of the boring. That portion of the section from the Elk Lick coal downward was measured with hand level on the steep slope directly east of the well. The portion above the latter coal was measured with aneroid. The coal at 767.67 feet was taken out with a percussion core drill and was supposed to represent the Upper Freeport bed, but it evidently correlates with the Upper Kittanning vein:

## Section at Sabraton, Morgan District.

| <i>Upper Carboniferous (792.25')</i>   |       | Thickness.                 | Total. |
|--|-------|----------------------------|--------|
| <b>Monongahela Series (45')</b>  |       | Feet.                      | Feet.  |
| Concealed from summit of hill $\frac{1}{2}$ mile north-east of State farm..... |       |                            |        |
|  | 10    | 10                         |        |
|  | 25    | 35                         |        |
|  | 10    | 45                         | 45'    |
| <b>Conemaugh Series (599')</b>   |       |                            |        |
|  | 236.4 | 281.4                      |        |
|  | 3.6   | 285                        | 240'   |
|  | 12    | 297                        |        |
|  | 14    | 311                        |        |
|  | 20    | 331                        |        |
|  | 5     | 336                        |        |
|  | 18    | 354                        |        |
|  | 6     | 360                        |        |
|  | 5     | 365                        |        |
| Sabraton Bore Hole No. 5 Record (334).<br>(Elevation of top, 875' L-A. T.)     |       |                            |        |
|  | 7     | 372                        |        |
|  | 1     | 373                        |        |
|  | 6     | 379                        | 94'    |
|  | 36    | 415                        |        |
|  | 15    | 430                        |        |
|  | 10    | 440                        |        |
|  | 30    | 470                        | 91'    |
|  | 43    | 513                        |        |
|  | 74    | 587                        |        |
|  | 2     | 589                        | 119'   |
|  | 55    | 644                        | 55'    |
| <b>Allegheny Series (148.25')</b>  |       |                            |        |
| Coal   | 1' 6" | } (Upper Freeport coal) .. | 5      |
| Shale  | 1 6   |                            |        |
| Coal   | 2 0   |                            |        |
| Fire clay  |       | 2                          | 651    |
| Sandstone, white   | 34'   | } Upper Freeport...        | 75     |
| Sandstone, dark  | 41    |                            |        |
| Coal, Lower Freeport   |       | 1                          | 727    |
| Fire clay  |       | 13                         | 740    |
| Shale, light sandy   |       | 14                         | 754    |
| Shale, dark, sandy   |       | 9                          | 763    |
| Slate, black, hard (4' 8")   |       | 4.67                       | 767.67 |
| Coal with bony streaks   | 2' 0" | } (Upper Kittanning) ..    | 2.75   |
| Slate  | 0 7   |                            |        |
| Coal   | 0 2   |                            |        |
| Slate, limy (13' 10")  |       | 13.83                      | 784.25 |
| Slate, black to bottom   |       | 8                          | 792.25 |

One-third mile southward the following section was obtained at the mouth of Aaron creek by combining a hand-lev-  
eled section measured on the steep point immediately to the  
southeast of the latter place with the log of the coal test Bore

Hole No. 3 (333) of the American Sheet & Tin Plate Co. The coal at 401.5 feet was taken out with a percussion core drill, and, at the time, was supposed to represent the Upper Freeport, but it evidently correlates with the Upper Kittanning:

**Section at Mouth of Aaron Creek, Morgan District.**

| <i>Upper Carboniferous (409')</i>           |      | <b>Thickness.</b> |              | <b>Total.</b> |
|---|------|-------------------|--------------|---------------|
| <b>Conemaugh Series (285')</b>              |      | <b>Feet.</b>      | <b>Feet.</b> |               |
| Limestone, shaly, Ames, marine fossils..... | 10   | 10                |              |               |
| Shale, gray .....                           | 1    | 11                |              |               |
| Coal, Harlem .....                          | 1    | 12                |              | 12            |
| Fire clay shale .....                       | 2    | 14                |              |               |
| Concealed to top Bore Hole No. 3 (333)..... | 23   | 37                |              |               |
| <b>Bore Hole No. 3 Record (333)</b>         |      |                   |              |               |
| (Elevation of top, 841' L-A. T.)            |      |                   |              |               |
| Surface gravel .....                        | 8    | 45                |              |               |
| Slate and shale.....                        | 20   | 65                |              |               |
| Sandstone, gray .....                       | 15   | 80                |              |               |
| Limestone .....                             | 7    | 87                |              |               |
| Sandstone, (Saltsburg) .....                | 18   | 105               |              |               |
| Slate .....                                 | 20   | 125               |              |               |
| Limestone, (Pine Creek).....                | 5    | 130               |              | 118'          |
| Slate .....                                 | 2    | 132               |              |               |
| Shale, red .....                            | 5    | 137               |              |               |
| Sandstone, (Buffalo).....                   | 74   | 211               |              |               |
| Slate, dark, Brush Creek.....               | 15   | 226               |              |               |
| Limestone .....                             | 20   | 246               |              |               |
| Shale, sandy (Mahoning Sandstone horizon)   | 36   | 282               |              |               |
| Slate, Uffington .....                      | 3    | 285               |              | 155'          |
| <b>Allegheny Series 124')</b>               |      |                   |              |               |
| Coal (½ slate), (Upper Freeport).....       | 4    | 289               |              |               |
| Slate, dark.....                            | 10   | 299               |              |               |
| Sandstone, (Upper Freeport).....            | 33   | 332               |              |               |
| Coal and slate, (Middle Freeport).....      | 3    | 335               |              | 50'           |
| Slate, brown .....                          | 25   | 360               |              |               |
| Coal, Lower Freeport.....                   | 1    | 361               |              | 26'           |
| Fire clay, dark.....                        | 8    | 369               |              |               |
| Fire clay, hard.....                        | 16   | 385               |              |               |
| Slate, brown, and shale, sandy.....         | 16.5 | 401.5             |              |               |
| Coal .....0' 9" } (1' 9½") Upper Kit-       |      |                   |              |               |
| Bone .....0 2 } tanning) .....              | 1.8  | 403.3             | 42.3'        |               |
| Coal .....0 5½ } .....                      |      |                   |              |               |
| Slate .....0 2½ } .....                     |      |                   |              |               |
| Coal .....0 2½ } .....                      |      |                   |              |               |
| Slate, limy (1' 8").....                    | 1.7  | 405               |              |               |
| Limestone, Johnstown Cement Bed to bottom   | 4    | 409               |              | 5.7'          |

Another accurate section for this region in which the formations are correctly identified is that made in conjunction with the log of the Diamond Drill Hole No. 2 (335) of the American Sheet & Tin Plate Co., located 3500 feet northeast of the Pressed Prism Glass Factory. This section was pub-

lished on page 628 of Vol. II(A) of the State Survey reports. The errors in correlation of the coals in other borings of this company as given on page 629 of the latter report, have been corrected on preceding pages of this chapter.

The following section was obtained near Rock Forge on Deckers creek by combining a hand-leveled section with the log of the churn drill Bore Hole No. 4 (336) of the same company:

**Section ½ Mile N. W. of Rock Forge, Morgan District.**

| <i>Upper Carboniferous (446.3')</i><br><b>Conemaugh Series (296')</b>          | Thickness. |       | Total. |
|--|------------|-------|--------|
|  | Feet.      | Feet. |        |
| Concealed .....  | 20         | 20    |        |
| Limestone, silicious, shaly, many marine fossils, Lower Ames.....              | 1          | 21    |        |
| Shale, gray .....  | 0.5        | 21.5  |        |
| Coal, Harlem .....   | 1.5        | 23    | 23'    |
| Fire clay shale.....   | 7          | 30    |        |
| Limestone, gray, brecciated, Ewing.....  | 1          | 31    |        |
| Concealed to top Bore Hole No. 4 (336).....                                    | 13         | 44    | 21'    |
| <b>Bore Hole No. 4 Record (336)</b><br>(Elevation of well mouth, 926' L-A. T.) |            |       |        |
| Gravel .....   | 8          | 52    |        |
| Shale .....  | 8          | 60    |        |
| Limestone .....  | 2          | 62    |        |
| Shale .....  | 17         | 79    |        |
| Limestone and shale, mixed.....  | 30         | 109   |        |
| Sandstone, (Saltsburg) .....   | 40         | 149   | 105'   |
| Slate or shale .....   | 25         | 174   |        |
| Sandstone, (Buffalo) .....   | 56         | 230   |        |
| Coal (local) .....   | 1          | 231   |        |
| Sandstone .....  | 5          | 236   |        |
| Slate, Brush Creek.....  | 8          | 244   |        |
| Coal and slate, (Brush Creek).....   | 3          | 247   | 98'    |
| Shale, sandy (Mahoning sandstone horizon)                                      | 49         | 296   | 49'    |
| <b>Allegheny Series (150.3')</b>   |            |       |        |
| Coal, and slate (Upper Freeport).....  | 4          | 300   |        |
| Fire clay .....  | 2          | 302   |        |
| Sandstone, (Upper Freeport).....   | 43         | 345   |        |
| Slate .....  | 4          | 349   |        |
| Sandstone, dark .....  | 20         | 369   |        |
| Sandstone, white.....  | 12         | 381   |        |
| Coal, bony, (Lower Freeport).....  | 1          | 382   | 82'    |
| Slate, black (4").....   | 0.3        | 382.3 |        |
| Fire clay .....  | 24         | 406.3 |        |
| Shale, dark, sandy.....  | 8          | 414.3 |        |
| Sandstone, dark .....  | 7          | 421.3 |        |
| Coal, (Upper Kittanning).....  | 3          | 424.3 | 42.3'  |
| Dark slate and shale.....  | 10         | 434.3 |        |
| Limestone, hard, (Johnstown Cement).....                                       | 8          | 442.3 |        |
| Sandstone, brown, to bottom.....   | 4          | 446.3 | 22'    |

The following hand-leveled section was measured by Mr. Reger from the summit of a high knob, located 0.8 mile southwest of Sturgis, northeastward to Deckers creek. It includes the Pottsville, Mauch Chunk and a portion of the Greenbrier Limestone:

**Section at Sturgis, Morgan District.**

|  | Thickness. | Total. |
|--|------------|--------|
|  | Feet.      | Feet.  |
| <i>Upper Carboniferous (322')</i>          |            |        |
| <b>Pottsville Series (322')</b>            |            |        |
| Sandstone, gray, massive, capping knob     |            |        |
| Homewood .....                             | 46         | 46     |
| Concealed .....                            | 55         | 101    |
| Sandstone, massive, pebbly, quarry rock at |            |        |
| Sturgis sand plant, Upper Connoque-        |            |        |
| nessing .....                              | 65         | 166    |
| Fire clay shale, brown and sandy.....      | 4          | 170    |
| Shale, brown and sandy.....                | 2          | 172    |
| Concealed .....                            | 110        | 282    |
| Sandstone, massive, Sharon.....            | 40         | 322    |
| Coal streak ( $\frac{1}{8}$ " ).....       | 0          | 322    |
| <i>Lower Carboniferous (408')</i>          |            |        |
| <b>Mauch Chunk (405')</b>                  |            |        |
| Concealed .....                            | 377        | 699    |
| Shale, red .....                           | 38         | 737    |
| <b>Greenbrier Limestone</b>                |            |        |
| Limestone, gray and hard, marine fossils.  |            |        |
| "Big Lime" .....                           | 56         | 793    |
| Concealed to Deckers Creek.....            | 27         | 820    |

The portion of the section included in the Mauch Chunk rocks was measured nearly due northward on the rapid dip of the strata; hence, the thickness of the latter series is shown about 100 feet greater than it should be.

CLINTON DISTRICT.—Clinton district occupies the southeastern portion of Monongalia county. The outcropping rocks within its area belong in the Monongahela, Conemaugh, Allegheny and Pottsville series.

The following hand-leveled section was measured down the steep eastern hillside of the Monongahela river, along the western border of Clinton district, from the summit of the knob located  $\frac{1}{2}$  mile northwest of Little Falls station. The section gives almost vertical measurements between important formations of the Conemaugh and Allegheny series. It also shows the true position of the Lower Connellsville sandstone which forms a prominent escarpment near the summit of the knob from which a grand view of the river is obtained:



## Section ½ Mile Northeast of Little Falls, Clinton District.

| <i>Upper Carboniferous (571')</i>  |        | Thickness.            | Total. |     |
|--|--------|-----------------------|--------|-----|
| <i>Conemaugh Series (532.5')</i>   |        | Feet.                 | Feet.  |     |
| Sandstone, massive, pebbly, capping knob   |        |                       |        |     |
| Connellsville .....  | 6      | 6                     |        |     |
| Shale, yellowish, sandy.....   | 10     | 16                    |        |     |
| Sandstone, greenish, medium grained, massive, forming cliff, Lower Connellsville.... | 47     | 63                    | 63'    |     |
| Shale .....  | 5      | 68                    |        |     |
| Concealed with reds.....   | 16     | 84                    |        |     |
| Shale, red.....  | 26     | 110                   |        |     |
| Concealed .....  | 10     | 120                   |        |     |
| Shale, buff.....   | 15     | 135                   |        |     |
| Slate, black.....  | 1      | 136                   |        |     |
| Concealed and shale.....   | 36     | 172                   |        |     |
| Fire clay and shale.....   | 4      | 176                   |        |     |
| Sandstone, massive, Grafton.....   | 24     | 200                   |        |     |
| Shale and concealed.....   | 19     | 219                   |        |     |
| Shale, dark gray.....  | 5      | 224                   |        |     |
| Shale, dark green, full of marine shells, Ames                                       | 16     | 240                   |        |     |
| Concealed .....  | 5      | 245                   |        |     |
| Coal blossom, Harlem (1151' L-A. T.).....  | 1      | 246                   | 181'   |     |
| Fire clay and gray shale.....  | 15     | 261                   |        |     |
| Concealed .....  | 36     | 297                   |        |     |
| Fire clay shale.....   | 5      | 302                   |        |     |
| Concealed .....  | 11     | 313                   |        |     |
| Shale, yellow and brown, hard, ferriferous...  | 4      | 317                   |        |     |
| Concealed .....  | 11     | 328                   |        |     |
| Fire clay shale.....   | 5      | 333                   |        |     |
| Sandstone, shaly and sandy shells.....   | 21     | 354                   |        |     |
| Sandstone, massive .....   | 9      | 363                   |        |     |
| Shale, sandy.....  | 7      | 370                   |        |     |
| Sandstone, massive, buff, Buffalo.....   | 67     | 437                   | 191'   |     |
| Shale, dark, Brush Creek, and concealed....  | 16     | 453                   |        |     |
| Shale, buff and brown.....   | 5      | 458                   |        |     |
| Limestone, silicious, nodular, shaly and ferriferous .....                           | 10.4   | 468.4                 |        |     |
| Shale, buff, brown and sandy.....  | 15.6   | 484                   |        |     |
| Concealed .....  | 21     | 505                   |        |     |
| Sandstone, massive, Mahoning.....  | 27.5   | 532.5                 | 95.5'  |     |
| <i>Allegheny Series (38.5')</i>  |        |                       |        |     |
| Coal .....   | 2' 1½" | } Upper Freeport coal | 3.5    | 536 |
| Slate, black.....  | 0 0½   |                       |        |     |
| Coal .....   | 0 7½   |                       |        |     |
| Slate, dark gray   | 0 0½   |                       |        |     |
| Coal .....   | 0 8    |                       |        |     |
| Fire clay and concealed to Pool No. 12 level of Monongahela river.....               | 35     | 571                   | 38.5'  |     |

The following hand-leveled section was measured near the central portion of Clinton district, southwestward nearly along the strike of the strata to the bed of Booths creek:

Section at Clinton Furnace, Clinton District.

| <i>Upper Carboniferous (345')</i>                        |                                       | Thickness. | Total. |       |
|--|---------------------------------------|------------|--------|-------|
| <b>Conemaugh Series (150')</b>                           |                                       | Feet.      | Feet.  |       |
| Concealed from top of knob.....                          |                                       | 150        | 150    | 150'  |
| <b>Allegheny Series (195')</b>                           |                                       |            |        |       |
| Coal, Upper Freeport.....                                |                                       | 5          | 155    |       |
| Concealed and shale.....                                 |                                       | 50         | 205    |       |
| Coal .....   | 0' 2" } Lower Freeport                |            |        |       |
| Slate, sandstone   | and shale.....7 1 } (1140' B-A, T, at |            |        |       |
| Coal .....   | 0 9 } base) .....                     | 8          | 213    | 63'   |
| Fire clay .....  |                                       | 4          | 217    |       |
| Sandstone, massive.....                                  |                                       | 5          | 222    |       |
| Shale .....  |                                       | 9          | 231    |       |
| Limestone, gray and hard, Lower Freeport.                |                                       | 2          | 233    |       |
| Shale, gray .....  |                                       | 4          | 237    |       |
| Sandstone, massive, Lower Freeport, upper division ..... |                                       | 11         | 248    |       |
| Coal, slaty (2") (local).....                            |                                       | 0.2        | 248.2  | 35.2' |
| Shale, dark and sandy.....                               |                                       | 9.8        | 258    |       |
| Concealed .....  |                                       | 11         | 269    |       |
| Shale, dark, sandy.....                                  |                                       | 5          | 274    |       |
| Coal .....   | 1' 9 " } Upper Kittanning coal        |            |        |       |
| Slate, gray...0 1½                                       | } .....                               | 2.6        | 276.6  | 28.4' |
| Coal .....   | 0 9 } .....                           |            |        |       |
| Fire clay and concealed.....                             |                                       | 30         | 306.6  |       |
| Sandstone, massive, Lower Freeport, lower division ..... |                                       | 20         | 326.6  |       |
| Coal, Lower Kittanning.....                              |                                       | 3          | 329.6  | 53'   |
| Concealed to bed of Booths creek.....                    |                                       | 15.4       | 345    | 15.4' |

The 2 inches of slaty coal at 248 feet from the top appears to be a local streak, since it was not noted in numerous other sections for eastern Monongalia and Marion counties.

The following aneroid section was measured along the southwest edge of Clinton district, from the summit of the knob just west of Triune, southwestward along the hill road to Whiteday creek:

Section at Triune, Clinton District.

| <i>Upper Carboniferous (381')</i>  |  | Thickness. | Total. |     |
|--|--|------------|--------|-----|
| <b>Conemaugh Series (168')</b>   |  | Feet.      | Feet.  |     |
| Sandstone, massive, coarse, brown and mottled, making cliffs and large boulders, Saltsburg ..... |  | 20         | 20     |     |
| Shale, brown and red.....  |  | 10         | 30     |     |
| Coal, blossom Bakerstown.....  |  | ..         | 30     | 30' |
| Concealed .....  |  | 15         | 45     |     |
| Sandstone, massive, Buffalo.....   |  | 45         | 90     | 60' |
| Concealed along bench.....   |  | 15         | 105    |     |

|  | Thickness. |       | Total. |
|--|------------|-------|--------|
|  | Feet.      | Feet. | Feet.  |
| Sandstone, massive, Mahoning.....                      | 40         | 145   |        |
| Concealed and sandstone, massive.....                  | 20         | 165   |        |
| Shale, gray.....                                       | 3          | 168   | 78'    |
| <b>Allegheny Series (213')</b>                         |            |       |        |
| Coal at opening...2' 0" } <b>Upper Freeport</b>        |            |       |        |
| Concealed by water .....1 0 } <b>coal</b> .....        | 3          | 171   |        |
| Concealed .....  | 155        | 326   |        |
| Coal, blossom, heavy, Lower Kittanning.....            | ..         | 326   | 158'   |
| Concealed to road fork, 1 mile S 15° W of Triune ..... | 20         | 346   |        |
| Concealed to Whiteday creek.....                       | 35         | 381   | 55'    |

The section reaches probably to the base of the Allegheny measures. The interval—128 feet—from the blossom of the Bakerstown coal down to the Upper Freeport bed is much shorter than it should be on account of the rapid rise in the strata from the former southeastward to the point where the observation was taken on the latter. The same is true to some extent for the Upper Freeport-Lower Kittanning coal interval which should be about 175 feet.

The following aneroid section was measured by D. B. Reger along the southwestern edge of Clinton district westward from the summit of a high hill, located one-half mile northeast of Anita. The intervals in that portion included in the Conemaugh series are greater than should be, owing to the dip of the rocks in the direction the section was measured:

#### Section ½ Mile North of Anita, Clinton District.

|   | Thickness. |       | Total. |
|---|------------|-------|--------|
|   | Feet.      | Feet. | Feet.  |
| <i>Upper Carboniferous (489')</i>                 |            |       |        |
| <b>Conemaugh Series (306')</b>                    |            |       |        |
| Shale .....                                       | 0.7        |       |        |
| Limestone, hard, marine fossils .....             | 0.3        |       |        |
| Ames.....   | 1          | 1     |        |
| Coal, Harlem.....                                 | 1          | 2     |        |
| Shale, concealed and shale.....                   | 132        | 134   |        |
| Sandstone and concealed.....                      | 60         | 194   |        |
| Sandstone, concealed and sandstone.....           | 45         | 239   |        |
| Concealed and shale.....                          | 67         | 306   | 306'   |
| <b>Allegheny Series (183')</b>                    |            |       |        |
| Coal, medium hard...1' 9" } <b>Upper Freeport</b> |            |       |        |
| Slate, black.....0 2 } <b>coal (3' 2")</b> ...    | 3          | 309   |        |
| Coal, soft.....1 3 } .....                        |            |       |        |
| Concealed .....                                   | 60         | 369   |        |
| Slate, black, Lower Freeport coal horizon..       | 0          | 369   | 63'    |
| Sandstone, massive, brown, Lower Freeport         | 40         | 409   |        |

|                                     | Thickness. | Total. |     |
|-------------------------------------|------------|--------|-----|
|                                     | Feet.      | Feet.  |     |
| Concealed .....                     | 40         | 449    |     |
| Coal blossom, Lower Kittanning..... | 0          | 449    | 80' |
| Shale with iron nuggets.....        | 15         | 464    |     |
| Sandstone, massive.....             | 10         | 474    |     |
| Concealed to Whiteday creek.....    | 15         | 489    | 40' |

**MARION COUNTY SECTIONS.**

MANNINGTON DISTRICT.—Mannington district occupies the western portion of Marion county; hence, its outcropping rocks are confined entirely to the Dunkard and Monongahela series.

The following section was obtained near Glover Gap by combining the log of the A. M. Glover No. 4 well (354) with the thickness of the Dunkard rocks cropping above the well to the southwest. The well is owned by the Venture Oil Company, and Patrick Gallagher, Supt., is authority for well record:

**Section 0.6 Mile Northwest of Glover Gap, Mannington District.**

|  | Thickness. | Total. |      |
|--|------------|--------|------|
|  | Feet.      | Feet.  |      |
| <i>Upper Carboniferous (2380')</i>                       |            |        |      |
| <b>Dunkard Series (940')</b>                             |            |        |      |
| Concealed from top knob 0.7 mile southwest of well ..... | 340        | 340    |      |
| <b>A. M. Glover No. 4 Well Record (354)</b>              |            |        |      |
| Unrecorded in well (gas in shale at 425' depth) .....    | 440        | 780    |      |
| Coal, Washington .....                                   | 2          | 782    |      |
| Unrecorded (gas in shale at 518' depth).....             | 131        | 913    |      |
| Sandstone, Bluff, (Waynesburg).....                      | 25         | 938    |      |
| Unrecorded .....   | 2          | 940    |      |
| <b>Monongahela Series (358')</b>                         |            |        |      |
| Coal, Fairview (Waynesburg).....                         | 3          | 943    |      |
| Unrecorded .....   | 255        | 1198   |      |
| Coal, Mapletown (Sewickley).....                         | 5          | 1203   | 263' |
| Unrecorded .....   | 89         | 1292   |      |
| Coal, Pittsburgh.....                                    | 6          | 1298   | 95'  |
| <b>Conemaugh (536')</b>                                  |            |        |      |
| Unrecorded .....   | 108        | 1406   |      |
| Sandstone, Murphy? (Minshall) (Connellsville) .....      | ..         | 1406   |      |
| Unrecorded .....   | 289        | 1695   | 397' |
| Sandstone, Little Dunkard? (Saltsburg).....              | ..         | 1695   |      |
| Unrecorded .....   | 80         | 1775   |      |
| Sandstone, Big Dunkard (Mahoning) .....                  | 59         | 1834   | 139' |
| <b>Allegheny Series (212')</b>                           |            |        |      |

|   | Thickness. | Total. |      |
|---|------------|--------|------|
|   | Feet.      | Feet.  |      |
| Unrecorded .....  | 100        | 1934   |      |
| Sandstone, Lower Freeport.....                              | 51         | 1985   |      |
| Unrecorded .....  | 61         | 2046   | 212' |
| <b>Pottsville Series (334')</b>                             |            |        |      |
| Gas? sand, Homewood and Upper Connoque-<br>nessing .....    | 137        | 2183   |      |
| Unrecorded .....  | 197        | 2380   | 334' |
| <i>Lower Carboniferous (710')</i>                           |            |        |      |
| <b>Mauch Chunk Series (123')</b>                            |            |        |      |
| Red rock .....  | 25         | 2405   |      |
| Unrecorded .....  | 20         | 2425   |      |
| Red rock.....   | 60         | 2485   |      |
| Limestone and unrecorded.....                               | 18         | 2503   | 123' |
| <b>Greenbrier Limestone (87')</b>                           |            |        |      |
| Big Lime.....   | 87         | 2590   |      |
| <b>Pocono Sandstones (500')</b>                             |            |        |      |
| Sand, Big Injun (gas, 2272'; oil and water,<br>2342') ..... | 158        | 2748   |      |
| Unrecorded .....  | 342        | 3090   | 500' |
| <i>Devonian (251')</i>                                      |            |        |      |
| <b>Catskill Sandstones (251')</b>                           |            |        |      |
| Unrecorded .....  | 122        | 3212   |      |
| Sand, Fifty-foot .....                                      | 84         | 3296   |      |
| Unrecorded .....  | 29         | 3325   |      |
| Sand, Thirty-foot (oil, 2985' and 2990') to<br>bottom ..... | 16         | 3341   | 251' |

The following section was obtained in the east central portion of Mannington district, Marion county, by combining a hand-leveled section measured by D. B. Reger from the summit of the high hill immediately south of Mannington with part of the log of the Fleming Hamilton No. 1 well (541), published on pages 241-242 of Vol. I of the State Survey reports. The correlations in parentheses are by the writer:

#### Section at Mannington, Mannington District.

|   | Thickness. | Total. |      |
|---|------------|--------|------|
|   | Feet.      | Feet.  |      |
| <i>Upper Carboniferous (2032')</i>                          |            |        |      |
| <b>Dunkard Series (507')</b>                                |            |        |      |
| Concealed from top of hill due south of<br>Mannington ..... |            |        |      |
| Shale and concealed.....                                    | 112        | 112    |      |
| Sandstone, shaly .....                                      | 25         | 137    |      |
| Shale, brown, and concealed .....                           | 6          | 143    |      |
| Sandstone, shaly.....                                       | 25         | 168    |      |
| Shale, silicious and variegated.....                        | 12         | 180    |      |
| Shale, limy and variegated.....                             | 28         | 208    |      |
| Sandstone, shaly, (Upper Marietta).....                     | 23         | 231    |      |
| Shale, red .....  | 22         | 253    | 253' |
| Shale, brown .....  | 17         | 270    |      |
| Shale, mostly red, (Creston).....                           | 12         | 282    |      |
|   | 24         | 306    |      |

|  | Thickness. | Total. |      |
|--|------------|--------|------|
|  | Feet.      | Feet.  |      |
| Concealed and shale.....   | 22         | 328    |      |
| Sandstone .....  | 6          | 334    |      |
| Shale .....  | 11         | 345    |      |
| Slate, dark .....  | 1          | 346    |      |
| Concealed .....  | 2          | 348    |      |
| Coal, slaty.....1' 6" }<br>Shale, gray.....2 0 } Washington coal....               | 5          | 353    | 100' |
| Coal .....1 6 }<br>Fire clay shale, gray....3' } Washington ....                   | 12         | 365    |      |
| Shale, yellowish.....0 }   |            |        |      |
| Sandstone, shaly.....  | 7          | 372    |      |
| Shale, green .....   | 6          | 378    |      |
| Concealed .....  | 5          | 383    |      |
| Sandstone, concealed, and sandstone, Man-<br>nington .....                         | 23         | 406    |      |
| Shale, brown, to top Hamilton No. 1 well<br>(541) .....                            | 26         | 432    |      |
| Fleming Hamilton No. 1 Well Record (541)<br>(Elevation, well mouth, 1055' B-A. T.) |            |        |      |
| Conductor .....  | 15         | 447    |      |
| Coal, Waynesburg "A".....  | 1          | 448    | 95'  |
| Slate .....  | 14         | 462    |      |
| Sandstone, (Waynesburg) .....  | 35         | 497    |      |
| Slate .....  | 10         | 507    | 59'  |
| <b>Monongahela Series (395')</b>   |            |        |      |
| Slate .....  | 15         | 522    |      |
| Sandstone, (Gilboy) (110' of 10" casing)....                                       | 30         | 552    |      |
| Limestone .....  | 40         | 592    |      |
| Slate .....  | 35         | 627    |      |
| Lime and shale .....   | 142        | 769    |      |
| Slate .....  | 8          | 777    |      |
| Coal, Sewickley .....  | 12         | 789    |      |
| Slate, (water and gas at 360').....  | 35         | 824    |      |
| Limestone .....  | 48         | 872    |      |
| Slate, dark .....  | 19         | 891    |      |
| Coal, Pittsburgh .....   | 11         | 902    |      |

The following section was obtained 3 miles southwest of Mannington by combining a hand-leveled section measured by D. B. Reger from the summit of a high knob northeastward along the hill road on the head of Whetstone run, with the log of the Michael Kennedy No. 1 well (516). The section is very interesting, in that three coals of the Dunkard series are noted; viz., Dunkard, Jollytown and Washington:

**Whetstone Run Section, Mannington District.**

| <i>Upper and Lower Carboniferous (2892')</i>                       | Thickness. | Total. |     |
|--|------------|--------|-----|
| <b>Dunkard Series (650')</b>                                       | Feet.      | Feet.  |     |
| Shale and concealed from top of knob.....                          | 21         | 21     |     |
| Sandstone, brown, flaggy, micaceous, fine<br>grained, Burton ..... | 55         | 76     | 76' |
| Concealed and limy shale.....                                      | 17         | 93     |     |

|  | Thickness.<br>Feet. | Total.<br>Feet. |      |
|--|---------------------|-----------------|------|
| Sandstone .....  | 6                   | 99              |      |
| Shale, brown .....   | 10                  | 109             |      |
| Sandstone, shaly .....   | 11                  | 120             |      |
| Shale, variegated .....  | 22                  | 142             |      |
| Sandstone, shaly, Rush Run.....  | 40                  | 182             |      |
| Shale, brown .....   | 15.7                | 197.7           |      |
| Coal (3"), Dunkard.....  | 0.3                 | 198             | 122' |
| Fire clay shale.....   | 2                   | 200             |      |
| Sandstone, brown, micaceous, hard, flaggy,<br>fine grained, Jollytown..... | 42                  | 242             |      |
| Shale, dark .....  | 5                   | 247             |      |
| Coal, slaty (9"), Jollytown.....   | 1                   | 248             | 50'  |
| Fire clay shale, gray.....   | 9                   | 257             |      |
| Sandstone, shaly.....14'   |                     |                 |      |
| Shale .....  | 4                   |                 |      |
| Sandstone, hard,<br>brown, flaggy, mi-<br>caceous .....                    | 31                  |                 |      |
| Hundred sandstone  | 49                  | 306             | 55'  |
| Shale, concealed, and shale.....   | 49                  | 355             |      |
| Shale, variegated, mostly red (Creston Reds)                               | 50                  | 405             |      |
| Sandstone .....  | 6                   | 411             |      |
| Shale variegated.....  | 25                  | 436             |      |
| Sandstone, concealed and sandstone, Lower<br>Marietta .....                | 30                  | 466             |      |
| Concealed and shale.....   | 16                  | 480             |      |
| Coal, Washington, to Michael Kennedy No. 1<br>well (516).....              | 4                   | 484             | 178' |
| Michael Kennedy No. 1 Well Record (516)                                    |                     |                 |      |
| Unrecorded .....   | 166                 | 650             | 166' |
| Monongahela Series (395')  |                     |                 |      |
| Unrecorded .....   | 385                 | 1035            |      |
| Coal, Pittsburgh .....   | 10                  | 1045            |      |
| Conemaugh Series (559')  |                     |                 |      |
| Unrecorded .....   | 497                 | 1542            |      |
| Sandstone, Dunkard (Mahoning) (oil and<br>some water, 1983').....          | 62                  | 1604            | 559' |
| Allegheny, Pottsville and Mauch Chunk Series (698')                        |                     |                 |      |
| Unrecorded .....   | 360                 | 1964            |      |
| Sand, Salt (Upper Connoquenessing).....                                    | 80                  | 2044            |      |
| Unrecorded .....   | 258                 | 2302            |      |
| Greenbrier Limestone (90')   |                     |                 |      |
| Big Lime.....  | 90                  | 2392            | 90'  |
| Pocono Sandstones (500')   |                     |                 |      |
| Sand, Big Injun (oil and some water, 1983')..                              | 108                 | 2500            |      |
| Unrecorded .....   | 392                 | 2892            | 500' |
| Devonian (356')  |                     |                 |      |
| Catskill Sandstones (356')   |                     |                 |      |
| Unrecorded .....   | 343                 | 3235            |      |
| Sand, Gordon (1st oil pay, 2751'; 2nd pay,<br>2764') to bottom.....        | 13                  | 3248            | 356' |

"8¼ inch casing, 1068'; 6½ inch casing, 2020'; 5 inch casing, 2732'. The well was completed July 4, 1893 and abandoned July 27, 1906. Initial production over 1000 barrels of oil daily. Shot with 4 quarts of nitro-glycerine—5 inch shell—Feb. 26, 1895, top of shot. 2762'; shot again with 8 quarts—5 inch shell—March 11, 1897, top of shot at 2762'; and shot again on August 29, 1898, with 25 quarts—10 inch shell—top of shot at 2750'."

**PAWPAW DISTRICT.**—Pawpaw district, Marion county, lies east of Mannington district, west of the Monongahela river, and south of and adjoining Monongalia county. The outcropping rocks therein are confined entirely to the Dunkard, Monongahela and Conemaugh series of the Carboniferous measures.

In the northwestern portion of the district, the following section was obtained by combining an aneroid section measured from the summit of the high knob on the head of Laurel run southwestward along the hill road, approximately on the strike of the strata, with part of the log of the Brice Wallace No. 1 well (555), published on pages 238-239 of Vol. I of the State Survey reports and located on a branch of Rush run, 1 mile northeast of Fairview. In that portion of the section made up from the well record, the writer has inserted in parentheses corrections in correlation as given in Vol. I as well as names for other formations. It is quite evident that the Washington, Waynesburg "A" and Waynesburg coals were placed too low in the measures in the latter publication.

### Section 1 Mile Northeast of Fairview, Pawpaw District.

| <i>Upper Carboniferous (2170')</i>       | Thickness. | Total. |      |
|--|------------|--------|------|
| <b>Dunkard Series (692')</b>             | Feet.      | Feet.  |      |
| Concealed and sandstone from top of knob |            |        |      |
| U. S. G. S. 1681' L-A. T.).....          | 35         | 35     |      |
| Concealed .....                          | 35         | 70     |      |
| Shale, buff, with thin sandstones.....   | 20         | 90     |      |
| Concealed .....                          | 10         | 100    |      |
| Sandstone, shaly, (Burton).....          | 25         | 125    |      |
| Concealed .....                          | 70         | 195    | 195' |
| Fire clay shale (Fish Creek).....        | 10         | 205    |      |
| Shale, buff .....                        | 14         | 219    |      |
| Sandstone, nodular .....                 | 1          | 220    |      |
| Shale, buff .....                        | 5          | 225    |      |
| Sandstone, flaggy and shaly.....         | 10         | 235    |      |
| Shale, buff .....                        | 9.7        | 244.7  |      |
| Coal (3"), Dunkard.....                  | 0.3        | 245    | 50'  |
| Fire clay and shale.....                 | 2          | 247    |      |
| Sandstone, massive .....                 | 7          | 254    |      |
| Fire clay shale.....                     | 3          | 257    |      |
| Sandstone, shaly .....                   | 8          | 265    |      |
| Concealed .....                          | 10         | 275    |      |
| Shale, sandy, red and variegated.....    | 25         | 300    |      |
| Sandstone .....                          | 5          | 305    |      |
| Concealed .....                          | 20         | 325    |      |
| Sandstone, shaly .....                   | 10         | 335    |      |



|  | Thickness. | Total. |      |
|--|------------|--------|------|
|  | Feet.      | Feet.  |      |
| Concealed .....  | 40         | 375    |      |
| Shale .....  | 5          | 380    |      |
| <b>Sandstone, massive, Upper Marietta</b> .....                            | 25         | 405    | 160' |
| Concealed .....  | 30         | 435    |      |
| Sandstone .....  | 5          | 440    |      |
| Concealed .....  | 15         | 455    |      |
| Shale, gray .....  | 5          | 460    |      |
| Sandstone .....  | 5          | 465    |      |
| Concealed .....  | 43         | 508    |      |
| Shale .....  | 1          | 509    |      |
| Coal, slaty (10"), Washington "Rider" .....                                | 1          | 510    |      |
| Concealed with shale .....   | 7          | 517    |      |
| <b>Coal, Washington (Base 1160' B-A. T.)</b> .....                         | 3          | 520    | 115' |
| Concealed to top Brice Wallace No. 1 well..                                | 35         | 555    |      |
| <b>Brice Wallace No. 1 Well Record (555)</b><br>(Elevation, 1025' B-A. T.) |            |        |      |
| Conductor (shutting off surface gravel and water) .....                    | 12         | 567    |      |
| Slate, white .....   | 30         | 597    |      |
| <b>Coal (Waynesburg "A")</b> .....   | 4          | 601    | 81'  |
| Slate and sandstone, Waynesburg .....                                      | 87         | 688    |      |
| Slate, (Cassville Plant Shale) .....                                       | 4          | 692    | 91'  |
| <b>Monongahela Series (397')</b>   |            |        |      |
| <b>Coal, (Waynesburg)</b> .....  | 7          | 699    |      |
| Slate .....  | 5          | 704    |      |
| <b>Sandstone, white, sharp, (Gilboy)</b> .....                             | 40         | 744    |      |
| <b>Coal, (Little Waynesburg)</b> .....                                     | 6          | 750    | 58'  |
| Limestone .....  | 39         | 789    |      |
| Slate and sandy shell .....  | 50         | 839    |      |
| Limestone .....  | 36         | 875    |      |
| Slate and limestone .....  | 60         | 935    |      |
| <b>Sandstone, sharp and white (Upper Sewickley)</b> .....                  | 40         | 975    |      |
| <b>Coal, Sewickley (water)</b> .....                                       | -10        | 985    | 235' |
| Slate, soft .....  | 25         | 1010   |      |
| <b>Limestone, hard (Sewickley)</b> .....                                   | 35         | 1045   |      |
| Slate .....  | 30         | 1075   |      |
| <b>Coal, Pittsburgh</b> .....  | 14         | 1089   | 104' |

The Wallace well was drilled on down to a depth of 1997 feet and proved a heavy gasser in the Big Injun sand.

The following aneroid section was measured in the southern point of Pawpaw district by D. B. Reger from the summit of a high knob, a mile and a half northwest of Rivesville, eastward along the hill road to the bed of Pawpaw creek at the mouth of Woods run:

## Section Northwest of Rivesville, Pawpaw District.

| <i>Upper Carboniferous (575')</i>  |                          | Thickness. | Total. |
|--|--------------------------|------------|--------|
| <b>Dunkard Series (405')</b>   |                          | Feet.      | Feet.  |
| Sandstone, capping knob.....   | 10                       | 10         |        |
| Shale, brown.....  | 35                       | 45         |        |
| Sandstone .....  | 10                       | 55         |        |
| Concealed and shale, variegated.....   | 90                       | 145        |        |
| Sandstone, brown .....   | 30                       | 175        |        |
| Concealed and shale.....   | 85                       | 260        |        |
| Sandstone, brown .....   | 15                       | 275        |        |
| Shale, variegated .....  | 35                       | 310        |        |
| Sandstone, shaly (Mannington) .....  | 28                       | 338        |        |
| Coal, Waynesburg "A".....  | 2                        | 340        | 340'   |
| Shale and concealed.....   | 29                       | 369        |        |
| Sandstone, massive, brown and pebbly,<br>Waynesburg .....  | 35                       | 404        |        |
| Shale, gray, Cassville Plant Shale.....  | 1                        | 405        | 65'    |
| <b>Monongahela Series (170')</b>   |                          |            |        |
| Coal, slaty..0' 6" }<br>Shale, gray.1 0 }<br>Coal, blocky 1 6 }<br>Slate, black.0 4 }<br>Coal, good..1 3 } | Waynesburg coal (4' 7"). | 5          | 410    |
| Concealed .....  | 20                       | 430        |        |
| Sandstone, massive, medium grained, gray<br>micaceous, Gilboy.....   | 25                       | 455        |        |
| Concealed .....  | 9                        | 464        |        |
| Coal, slaty, Little Waynesburg.....  | 1                        | 465        | 60'    |
| Limestone, hard, Waynesburg.....   | 10                       | 475        |        |
| Concealed and shale.....   | 5                        | 480        |        |
| Sandstone, massive, hard fine, green, Union-<br>town .....   | 10                       | 490        |        |
| Concealed .....  | 25                       | 515        | 50'    |
| Sandstone, green flaggy and fine.....  | 20                       | 535        |        |
| Limestone, concealed and limestone, Union-<br>town, to Pawpaw creek at mouth of Woods<br>run .....         | 40                       | 575        | 60'    |

The following hand-leveled section was measured by Mr. Reger in the extreme southern point of Pawpaw district from the summit of the high knob  $\frac{1}{2}$  mile northward from Dakota eastward to river level via the quarry in the Mannington sandstone ledge. This section is interesting in that it gives an accurate measurement between the Washington and Waynesburg coals on the eastern boundary of the Dunkard series.

## Section 0.3 Mile North of Dakota, Pawpaw District.

| <i>Upper Carboniferous (110')</i> |    | Thickness. | Total. |
|-----------------------------------|----|------------|--------|
| <b>Dunkard Series (214.5')</b>    |    | Feet.      | Feet.  |
| Concealed from top of knob.....   | 55 | 55         |        |
| Coal, Washington .....            | 4  | 59         |        |

|   | Thickness. | Total. |       |
|---|------------|--------|-------|
|   | Feet.      | Feet.  |       |
| Concealed and brown shale.....  | 60         | 119    |       |
| Sandstone, gray, massive, quarried for ballast, Mannington .....  | 23         | 142    | 83'   |
| Fire clay .....   | 0.5        | 142.5  |       |
| Concealed and sandstone.....  | 72         | 214.5  | 72.5' |
| <b>Monongahela Series (195.5')</b>  |            |        |       |
| Coal .....0' 8" }<br>Shale, gray..1 3 }<br>Coal, good..0 9 } <b>Waynesburg coal (5' 5")</b> 5.5 220<br>Coal, bony..0 8 } (Base, 1038' L-A. T.)<br>Coal, good..2 1 } |            |        |       |
| Concealed .....   | 70         | 290    |       |
| Sandstone .....   | 3          | 293    |       |
| Shale and concealed.....  | 17         | 310    |       |
| Sandstone, green, shaly, Unlontown.....   | 26         | 336    |       |
| Slate, black, Unlontown coal horizon.....   | 2          | 338    | 118'  |
| Limestone, shaly, yellow, Unlontown.....  | 9          | 347    |       |
| Shale, hard, green, limy.....   | 8          | 355    |       |
| Sandstone, massive, green.....  | 4          | 359    |       |
| Shale .....   | 3          | 362    |       |
| Sandstone, shaly.....   | 4          | 366    |       |
| Shale, green .....  | 6          | 372    |       |
| Limestone, Benwood, to pool No. 14 (848' L-A. T.) .....   | 38         | 410    | 72'   |

LINCOLN DISTRICT.—Lincoln district occupies the southern central portion of Marion county; hence, the outcropping rocks therein are confined entirely to the Dunkard, Monongahela and Conemaugh series of the Carboniferous.

The following section was obtained along the eastern border of Lincoln district by combining a hand-leveled section measured by D. B. Reger with the log of the J. L. Davis diamond drill boring (654), located on Buffalo creek, 0.7 miles eastward from Farmington, the record of which was published on page 129-130 of Vol. II of the State Survey reports:

#### Farmington (Underwood) Section, Lincoln District.

|   | Thickness. | Total. |      |
|---|------------|--------|------|
|   | Feet.      | Feet.  |      |
| <i>Upper Carboniferous (712.4')</i>   |            |        |      |
| <b>Dunkard Series (319')</b>  |            |        |      |
| Unrecorded from top knob, 0.6 mile North of boring .....  | 285        | 285    |      |
| Sandstone, massive, coarse, soft, buff and pebbly, Waynesburg .....   | 25         | 310    |      |
| Concealed .....   | 9          | 319    | 319' |
| <b>Monongahela Series (393.4')</b>  |            |        |      |
| Coal .....0' 6" }<br>Shale .....0 2 } <b>Waynesburg coal</b><br>Coal .....1 0 } (See Vol. II, p. 129) 6 325<br>Fire clay.....1 4 }<br>Coal .....3 0 } |            |        |      |

|   | Thickness.<br>Feet. | Total.<br>Feet. |                                |
|---|---------------------|-----------------|--------------------------------|
| Sandstone, massive, brown and steel gray, cross-bedded, Glnboy.....                       | 25                  | 350             |                                |
| Concealed .....   | 50                  | 400             |                                |
| Sandstone, shaly, Uniontown.....  | 17                  | 417             |                                |
| Shale, brown, Annabelle.....  | 10                  | 427             |                                |
| Slate, black, Uniontown coal horizon.....   | 0.5                 | 427.5           | 108.5'                         |
| Limestone, hard..2' 6" } Uniontown  |                     |                 |                                |
| Limestone, shaly..4 0 } Limestone .....   | 6.5                 | 434             |                                |
| Shale .....   | 15                  | 449             |                                |
| Sandstone, massive .....  | 3                   | 452             |                                |
| Shale, gray .....   | 2                   | 454             |                                |
| Limestone, silicious .....  | 2                   | 456             |                                |
| Shale, brown to top of J. L. Davis diamond drill boring (654) .....                       | 19                  | 475             | 47.5                           |
| J. L. Davis Diamond Drill Boring Record (654)<br>(Elevation of top of hole, 923' L-A. T.) |                     |                 |                                |
| Sand and clay surface (13' 2").....   | 13.1                | 488.16          |                                |
| Limestone, yellow and gray .....  | 9' 6"               |                 | } Benwood Limestone ...        |
| Shaly limestone and green shale.....  | 30 0                |                 |                                |
| Limestone, gray.....  | 5 0                 |                 |                                |
| Shale, green.....   | 5 0                 |                 |                                |
| Limestone, gray.....  | 14 0                |                 |                                |
| Limy shale .....  | 6 0                 |                 |                                |
| Sandstone, micaceous, with streaks of sandy shale, Upper Sewickley.....                   | 31.1                | 588.67          |                                |
| Black slate .....   | 1                   | 589.67          |                                |
| Coal .....  | 3' 0.               |                 | } Sewickley coal (6' 4")..     |
| Slate .....   | 0 2                 |                 |                                |
| Coal .....  | 3 2                 |                 |                                |
| Shale, soft and gray.....   | 6.5                 | 602.5           |                                |
| Limy shale .....  | 5.5                 | 608             |                                |
| Sandy shale .....   | 2.5                 | 610.5           |                                |
| Limy shale, gray, getting sandy at base....   | 18                  | 628.5           |                                |
| Limestone, gray .....   | 20' 0"              |                 | } Sewickley Limestone.         |
| Shale, green..  | 3 6                 |                 |                                |
| Limestone, gray .....   | 3 0                 |                 |                                |
| Limy shale and impure limestone (25' 8")..  | 25.7                | 680.8           |                                |
| Sandstone, micaceous, interstratified with dark sandy shale, Upper Pittsburgh.....        | 16.4                | 697.2           |                                |
| Shale, sandy (6' 1").....   | 6.1                 | 703.3           |                                |
| Coal "roof".....  | 1' 5 "              |                 | } Pittsburgh coal (9' 1")..... |
| Over clay.....  | 0 7½                |                 |                                |
| Bone coal.....  | 0 2½                |                 |                                |
| Coal, good.....   | 2 8                 |                 |                                |
| Coal with thin slates.....  | 0 4                 |                 |                                |
| Coal, good.....   | 3 10                |                 |                                |
|   | 9.1                 | 712.4           |                                |

That portion of the above section from the top of the Waynesburg sandstone down to the top of the bore hole was measured by Mr. Reger with hand-level, and the results show

the thickness of the Monongahela series to be 35 feet less than that given for the Farmington section on page 130 of Vol. II of the State Survey reports. This discrepancy is no doubt due to the fact that that portion of the latter section above the well mouth was measured with aneroid.

The following section was obtained along the north-western border of Lincoln district by combining measurements made by Mr. Reger with the log of the Rezin Amos No. 1 well (599), located on the east bank of Mods run, one mile and three-tenths northward from Downs Station (Broomfield P. O). The well was completed July 18, 1890, and the log furnished by J. Garber, Contractor:

#### Section North of Downs, Lincoln District.

| <i>Upper Carboniferous (1873')</i>  | Thickness. Total. |       |
|---|-------------------|-------|
|   | Feet.             | Feet. |
| <b>Dunkard Series (410')</b>  |                   |       |
| Unrecorded from summit of knob $\frac{1}{2}$ mile northeast of well (599).....      | 250               | 250   |
| Coal, Washington, old opening, thickness concealed .....                            | ..                | 250   |
| Concealed (hand-level measurement) to Amos No. 1 well (599).....                    | 50                | 300   |
| <b>Rezin Amos No. 1 Well Record (599)</b><br>(Elevation top of hole, 1117' L-A. T.) |                   |       |
| Conductor .....   | 10                | 310   |
| Slate .....   | 6                 | 316   |
| Lime .....  | 8                 | 324   |
| Slate .....   | 8                 | 332   |
| Coal, (Waynesburg "A").....   | 2                 | 334   |
| Slate .....   | 11                | 345   |
| Sandstone, hard, (Waynesburg).....  | 55                | 400   |
| Slate, (Cassville Plant Shale).....   | 10                | 410   |
| <b>Monongahela Series (407')</b>  |                   |       |
| Coal, Waynesburg.....   | 4                 | 414   |
| Sandstone, hard, (Gilboy).....  | 31                | 445   |
| Lime .....  | 3                 | 448   |
| Slate .....   | 5                 | 453   |
| Lime .....  | 5                 | 458   |
| Slate .....   | 6                 | 464   |
| Lime, white.....  | 15                | 479   |
| Slate .....   | 11                | 490   |
| Lime .....  | 10                | 500   |
| Slate, black (Uniontown coal horizon belongs near base).....                        | 15                | 515   |
| Lime .....  | 10                | 525   |
| Slate .....   | 4                 | 529   |
| Lime .....  | 36                | 565   |
| Sandstone, (Arnoldsburg) .....  | 7                 | 572   |
| Lime, (Benwood) .....   | 78                | 650   |
| Slate .....   | 10                | 660   |

|   | Thickness. | Total. |      |
|---|------------|--------|------|
|   | Feet.      | Feet.  |      |
| Sand, (Upper Sewickley).....                      | 20         | 680    |      |
| Coal, Mapletown (Sewickley).....                  | 7          | 687    | 115' |
| Lime .....  | 53         | 775    | }    |
| Slate .....                                       | 10         |        |      |
| Lime .....  | 25         |        |      |
| Slate, white .....                                | 10         | 785    |      |
| Slate, black, .....                               | 25         | 810    |      |
| Coal, Pittsburgh.....                             | 7          | 817    | 130' |
| <b>Conemaugh Series (593')</b>                    |            |        |      |
| Slate .....                                       | 28         | 845    |      |
| Lime .....  | 40         | 885    |      |
| Sand, hard, (Connellsville).....                  | 25         | 910    |      |
| Lime .....  | 35         | 945    |      |
| Sand, (Lower Connellsville).....                  | 10         | 955    |      |
| Slate .....                                       | 35         | 990    |      |
| Lime .....  | 10         | 1000   |      |
| Slate, red .....                                  | 50         | 1050   |      |
| Slate .....                                       | 30         | 1080   |      |
| Lime, (Ames).....                                 | 10         | 1090   | 273' |
| Slate .....                                       | 25         | 1115   |      |
| Slate, red (Pittsburgh Reds).....                 | 20         | 1135   |      |
| Lime .....  | 22         | 1157   |      |
| Sand, Saltsburg.....                              | 30         | 1187   | 97'  |
| Slate .....                                       | 29         | 1216   |      |
| Sand, (Buffalo) .....                             | 17         | 1233   |      |
| Slate .....                                       | 67         | 1300   |      |
| Lime .....  | 10         | 1310   |      |
| Sand, Mahoning.....                               | 100        | 1410   | 223' |
| <b>Allegheny Series (202')</b>                    |            |        |      |
| Slate .....                                       | 30         | 1440   |      |
| Slate and shale .....                             | 75         | 1515   |      |
| Sandstone, (Lower Freeport).....                  | 15         | 1530   |      |
| Shale .....                                       | 24         | 1554   |      |
| Slate, black.....                                 | 58         | 1612   | 202' |
| <b>Pottsville Series (261')</b>                   |            |        |      |
| Sandstone, Homewood.....                          | 60         | 1672   |      |
| Shale .....                                       | 84         | 1756   |      |
| Sandstone, (Upper and Lower Connoquenesing) ..... | 117        | 1873   | 261' |
| <i>Lower Carboniferous (386')</i>                 |            |        |      |
| <b>Mauch Chunk Series (177')</b>                  |            |        |      |
| Shale .....                                       | 127        | 2000   |      |
| Lime .....  | 20         | 2020   |      |
| Slate, red .....                                  | 30         | 2050   | 177' |
| <b>Greenbrier Limestone (105')</b>                |            |        |      |
| Lime (Big Lime).....                              | 105        | 2155   | 105' |
| <b>Pocono Sandstones (104')</b>                   |            |        |      |
| Sandstone .....                                   | 56         | 2259   | }    |
| Lime .....  | 10         |        |      |
| Sand, hard (oil, 1932').....                      | 24         |        |      |
| Sand, soft .....                                  | 7          |        |      |
| Sand, hard, (oil, increased) to bottom.....       | 7          |        |      |
|   | 104        |        | 104' |

In the southern edge of Lincoln district D. B. Reger measured the following hand-leveled section southward from the summit of a high hill to West Fork river at the mouth of Tevebaugh creek. Owing to the dip of the strata in the opposite direction to that in which the section was measured, the intervals are slightly less than they should be:

**Section ¼ Mile West of Worthington, Lincoln District.**

| <i>Upper Carboniferous (526')</i>                     | Thickness. | Total |      |
|---|------------|-------|------|
| <b>Dunkard Series (204')</b>                          | Feet.      | Feet. |      |
| Concealed from top of hill to well (648).....         | 28         | 28    |      |
| Concealed .....                                       | 130        | 158   |      |
| <b>Sandstone, massive, coarse and pebbly,</b>         |            |       |      |
| <b>Waynesburg</b> .....                               | 44         | 202   |      |
| Shale, gray, Cassville.....                           | 2          | 204   | 204' |
| <b>Monongahela Series (322')</b>                      |            |       |      |
| Coal, Waynesburg .....                                | 7          | 211   |      |
| Concealed .....                                       | 26         | 237   |      |
| Sandstone, shaly, Gilboy.....                         | 4          | 241   |      |
| Concealed .....                                       | 23         | 264   |      |
| Sandstone, shaly.....                                 | 10         | 274   |      |
| Shale, gray.....                                      | 12         | 286   |      |
| Coal, Uniontown, thickness concealed.....             | 0          | 286   | 82'  |
| Limestone, hard, Uniontown.....                       | 4          | 290   |      |
| Concealed .....                                       | 39         | 329   |      |
| Sandstone .....                                       | 6          | 335   |      |
| Concealed and limestone.....                          | 20         | 355   |      |
| Concealed .....                                       | 15         | 370   |      |
| Coal, Lower Uniontown.....                            | 1          | 371   | 85'  |
| Limestone, silicious, Benwood.....                    | 43         | 414   |      |
| Shale, silicious gray.....                            | 21         | 435   |      |
| Sandstone, massive .....                              | 2          | 437   |      |
| Shale, gray.....                                      | 2          | 439   |      |
| Coal, Sewickley (Base, 949' L-A. T.).....             | 6          | 445   | 74'  |
| Shale, gray and limy.....                             | 36         | 481   |      |
| Limestone, hard, Sewickley.....                       | 10         | 491   |      |
| Shale, gray and limy.....                             | 5          | 496   |      |
| Sandstone, shaly.....                                 | 2          | 498   |      |
| Shale, gray .....                                     | 6          | 504   |      |
| Concealed to river, mouth of Tevebaugh<br>creek ..... | 22         | 526   | 81'  |

The section lacks 45 to 50 feet of reaching to the base of the Monongahela series; hence, the Pittsburgh coal lies about 40 feet below the river at the mouth of Tevebaugh creek.

North 30° east, 2.4 miles from Worthington the Fairmont Coal (now Consolidation Coal) Company put down their diamond drill Bore Hole No. 2 (660) on the J. L. Jones tract on Little Mill Fall run, the detailed record of which is published

on pages 676-677 of Vol. II (A) of the State Survey reports. This is a very important record in that it gives an accurate measurement of the thickness—419' 10"—of the Monongahela series where the latter appears to have reached its maximum development. Most of the increase seems to have taken place in the interval separating the Sewickley and Pittsburgh coals.

**FAIRMONT DISTRICT.**—Fairmont district occupies that portion of Marion county lying eastward from Lincoln district to the Monongahela and West Fork rivers; hence, the outcropping rocks therein belong in the Dunkard, Monongahela and Conemaugh series.

The following section was obtained in the southwest edge of the district by combining a hand-leveled section measured along the hill road to the Nancy Martin Diamond Drill Boring No. 6 (659) of the Consolidation Coal Co., located on Mill Fall run, one mile and two-fifths northwest of Monongah. In the hand-leveled portion of the section, the intervals and thicknesses of formations are slightly less than they should be on account of the measurements being taken in descending order along the rise of the strata; hence, a corresponding reduction in the thickness of the Monongahela series:

**Section 1.4 Miles Northwest of Monongah, Fairmont District.**

| <i>Upper Carboniferous (573.9')</i>  | Thickness.            | Total.  |       |
|--|-----------------------|---------|-------|
| <b>Dunkard Series (191.5')</b>   | Ft. In.               | Ft. In. |       |
| Shales capping hill 0.4 mile northeast of boring (659).....  | 8 0                   | 8 0     |       |
| Coal, Washington (1338' L-A. T.).....  | 3 0                   | 11 0    | 11'   |
| Concealed .....  | 20 0                  | 31 0    |       |
| Fire clay shale.....   | 5 0                   | 36 0    |       |
| Shale, brown and red.....  | 21 0                  | 57 0    |       |
| Concealed and shale.....   | 21 0                  | 78 0    |       |
| Sandstone, massive, Mannington.....  | 21 0                  | 99 0    |       |
| Concealed .....  | 10 0                  | 109 0   | 98'   |
| Fire clay shale.....   | 10 0                  | 119 0   |       |
| Shale .....  | 4 0                   | 123 0   |       |
| Sandstone, massive, coarse brown and pebbly, Waynesburg.....   | 68 0                  | 191 0   |       |
| Shale, gray .....  | 0 6                   | 191 6   | 82.5' |
| <b>Monongahela Series (381.2')</b>   |                       |         |       |
| Coal ....0' 9 " }<br>Slate ...0 0½ }<br>Coal ....0 11 }<br>Shale. }<br>gray ..1 2½ }<br>Coal ....3 6 } | Waynesburg coal.. 6 5 | 197 11  |       |



|  | Thickness.   | Total.    |        |
|--|--|-----------|--------|
|  | Feet. In.  | Feet. In. |        |
| Concealed .....  | 9 1  | 207 0     |        |
| Sandstone, shaly top, massive at bot-<br>tom, Gliboy .....           | 30 0   | 237 0     |        |
| Concealed .....  | 5 0  | 242 0     |        |
| Shale, sandy .....   | 20 0   | 262 0     |        |
| Coal .....0' 4"  | } Uniontown coal   | 1 0       | 263 0  |
| Shale, gray....0 1   |  |           |        |
| Coal .....0 7  |  |           |        |
| Fire clay and shale.....   | 13 0   | 276 0     |        |
| Concealed .....  | 8 0  | 284 0     |        |
| Sandstone, massive.....  | 26 0   | 310 0     |        |
| Concealed .....  | 5 0  | 315 0     |        |
| Limestone, yellowish.....  | 5 0  | 320 0     |        |
| Concealed to Bore Hole No. 6 (659)..                                 | 26 0   | 346 0     | 83'    |
| Nancy Martin Boring No. 6 Record (659).<br>(Elevation, 998' L-A. T.) |  |           |        |
| Surface .....  | 8 0  | 354 0     |        |
| Lime and fire clay.....  | 28 0   | 382 0     |        |
| Shale, light .....   | 4 0  | 386 0     |        |
| Lime .....8' 10"   | } Benwood Limestone  | 41 2      | 427 2  |
| Shale,<br>light ....4 2  |  |           |        |
| Lime .....9 3  |  |           |        |
| Sand .....4 2  |  |           |        |
| Shale,<br>gray ... 4 8   |  |           |        |
| Fire clay and<br>lime ...10 1  |  |           |        |
| Sand Upper Sewickley.....  |  |           |        |
| Slate, dark .....  | 11 0   | 441 4     |        |
| Coal .....2' 2 "   | } Sewickley coal..   | 6 5       | 447 9  |
| Slate, black..0 0½   |  |           |        |
| Coal .....4 2½   |  |           |        |
| Fire clay .....  | 6 8  | 454 5     |        |
| Sand, Lower Sewickley.....   | 15 3   | 469 8     |        |
| Shale, sandy .....   | 6 5  | 476 1     |        |
| Fire clay .....  | 1 8  | 477 9     |        |
| Sand .....   | 10 7   | 488 4     |        |
| Fire clay.....   | 1 5  | 489 9     |        |
| Lime, Sewickley.....   | 14 9   | 504 6     |        |
| Shale, light .....   | 7 5  | 511 11    |        |
| Fire clay .....  | 15 9   | 527 8     |        |
| Shale, sandy .....   | 4 0  | 531 8     |        |
| Fire clay .....  | 5 7  | 537 3     |        |
| Shale, dark .....  | 6 0  | 543 3     |        |
| Shale, sandy .....   | 5 0  | 548 3     |        |
| Slate, dark.....   | 10 1   | 558 4     |        |
| Sand .....   | 2 10   | 561 2     |        |
| Slate, black .....   | 1 10   | 563 0     |        |
| Coal .....0' 5 "   | } Pittsburgh Coal<br>(Elevation of base,<br>771.29 L-A. T.). | 9 8½      | 572 8½ |
| Slate .....0 9   |  |           |        |
| Coal .....3 8  |  |           |        |
| Bone .....0 1  |  |           |        |
| Coal .....0 4  |  |           |        |
| Bone .....0 0½   |  |           | 124.9' |
| Coal .....4 5  |  |           |        |

|                                  | Thickness.<br>Feet. In. | Total.<br>Feet. In. |     |
|----------------------------------|-------------------------|---------------------|-----|
| <b>Conemaugh Series (1' 2½")</b> |                         |                     |     |
| Slate .....                      | 0 9                     | 573 5½              |     |
| Fire clay to bottom.....         | 0 5½                    | 573 11              | 12' |

The following hand-leveled section was measured southward to Buffalo creek by D. B. Reger from the summit of the high knob located 0.8 mile north 60° east from Barrackville station. It shows the relative position of the cropping rocks along the eastern border of Fairmont district:

### Section 0.7 Mile East of Barrackville, Fairmont District.

|   | Thickness.<br>Feet. | Total.<br>Feet. |      |
|---|---------------------|-----------------|------|
| <i>Upper Carboniferous (434')</i>   |                     |                 |      |
| <b>Dunkard Series (254')</b>  |                     |                 |      |
| Sandstone, capping knob, 0.8 mile north 60° east of Barrackville Station..... | 10                  | 10              |      |
| Concealed and shale.....  | 68                  | 78              |      |
| Coal, Washington (about 4 feet).....  | 4                   | 82              | 82'  |
| Shale and concealed.....  | 55                  | 137             |      |
| Sandstone, massive, Mannington.....   | 33                  | 170             |      |
| Shale and concealed.....  | 17                  | 187             |      |
| Coal, Waynesburg "A" (thickness concealed)                                    | 0                   | 187             | 105' |
| Concealed .....   | 12                  | 199             |      |
| Sandstone .....   | 5                   | 204             |      |
| Shale and concealed.....  | 17                  | 221             |      |
| Limestone, hard .....   | 4                   | 225             |      |
| Sandstone, massive, Waynesburg.....   | 18                  | 243             |      |
| Concealed .....   | 11                  | 254             | 67'  |
| <b>Monongahela Series (180')</b>  |                     |                 |      |
| Coal, Waynesburg (about 4 feet).....  | 4                   | 258             |      |
| Concealed .....   | 15                  | 273             |      |
| Sandstone, Gilboy.....  | 9                   | 282             |      |
| Concealed .....   | 11                  | 293             |      |
| Limestone, hard, Waynesburg.....  | 7                   | 300             |      |
| Concealed .....   | 12                  | 312             |      |
| Sandstone, shaly, concealed and sandstone, Uniontown .....                    | 33                  | 345             |      |
| Shale, gray, Annabelle.....   | 12                  | 357             |      |
| Slate, black, thickness concealed (Uniontown coal horizon).....               | 0                   | 357             | 103' |
| Shale and limestone .....5' } Uniontown Limestone.                            |                     |                 |      |
| Sandstone, limy...2 }   | 11                  | 368             |      |
| Limestone and shale .....4 }  |                     |                 |      |
| Sandstone .....   | 4                   | 372             |      |
| Concealed and shale.....  | 14                  | 386             |      |
| Sandstone, hard, green, massive, fine grained, Arnoldsburg? .....             | 14                  | 400             | 43'  |
| Shale, limestone and shale.....   | 12                  | 412             |      |
| Limestone, Benwood, to Buffalo creek.....                                     | 22                  | 434             | 34'  |

The following section was obtained near the central portion of Fairmont district, on Ice's run, one mile northwest of Fairmont, by combining a hand-leveled section measured by D. B. Reger from the summit of a high knob westward, with the log of the Shore Diamond Drill Boring No. 7 (672). The record of the latter was kindly furnished by the Consolidation Coal Co. Eight coal beds are noted in the section:

Ice's Run—Fairmont Section, Fairmont District.

| Upper Carboniferous (602.4')   |   | Thickness. | Total. |      |
|--|---|------------|--------|------|
| Dunkard Series (207')  |   | Ft. In.    | Ft. In |      |
| Concealed from top of knob located 0.4 mile eastward from boring (672).... |   | 46 0       | 46 0   |      |
| Coal, Washington (about 2 feet) (1253' L-A. T.).....                       |   | 2 0        | 48 0   | 48'  |
| Shale, yellow .....  |   | 32 0       | 80 0   |      |
| Concealed .....  |   | 100 0      | 180 0  |      |
| Sandstone, Waynesburg .....  |   | 24 0       | 204 0  |      |
| Shale, fossil plants, Cassville.....                                       |   | 3 0        | 207 0  | 159' |
| Monongahela Series (393.8')  |   |            |        |      |
| Coal, hard...0' 7"   | } (3' 10") Waynesburg Coal...<br>(Elevation of base, 1090' L-A. T.) |            |        |      |
| Shale, gray....1 5   |   | 4 0        | 211 0  |      |
| Coal .....0 8  |   |            |        |      |
| Shale, gray....0 4   |   |            |        |      |
| Coal .....0 10   |   |            |        |      |
| Concealed .....  |   | 40 0       | 251 0  |      |
| Coal, streak, Little Waynesburg.....                                       |   | 0 0        | 251 0  |      |
| Concealed and shale.....   |   | 11 0       | 262 0  |      |
| Sandstone, green, shaly, Unlontown..                                       |   | 22 0       | 284 0  |      |
| Concealed .....  |   | 10 0       | 294 0  |      |
| Coal, Unlontown .....  |   | 1 0        | 295 0  | 88'  |
| Shale and concealed to Shore Bore Hole No. 7 (672).....                    |   | 22 0       | 317 0  |      |
| Shore Bore Hole No. 7 Record (672) (Elevation of top, 984.24' L-A. T.)     |   |            |        |      |
| Surface .....  |   | 9 0        | 326 0  |      |
| Lime, sandy.....   |   | 20 0       | 346 0  |      |
| Fire clay .....  |   | 9 6        | 355 6  |      |
| Shale, light .....   |   | 6 0        | 361 6  |      |
| Fire clay .....  |   | 2 8        | 364 2  |      |
| Shale, light .....   |   | 9 10       | 374 0  |      |
| Shale, red .....   |   | 3 0        | 377 0  |      |
| Lime .... 2' 0"  | } Benwood Limestone   |            |        |      |
| Fire clay. 4 0   |   | 77 1       | 454 1  |      |
| Lime ....35 0  |   |            |        |      |
| Fire clay. 3 2   |   |            |        |      |
| Lime with shale streaks 32 11  |   |            |        |      |
| Shale, sandy.....  |   | 8 5        | 462 6  |      |
| Slate, dark.....   |   | 4 6        | 467 0  |      |

|  | Thickness.<br>Feet. In.   | Total.<br>Feet. In. |        |
|--|---|---------------------|--------|
| Coal .....1' 9"                        | } Sewickley coal.. 5 5<br>(Elevation of base, 828.82' L-A. T.)    | 472 5               | 177.4' |
| Lime .....0 3                          |   |                     |        |
| Coal .....0 2                          |   |                     |        |
| Binder .....0 1                        |   |                     |        |
| Coal .....0 4                          |   |                     |        |
| Slate binder...0 2                     |   |                     |        |
| Coal .....1 8                          |   |                     |        |
| Slate binder...0 3                     |   |                     |        |
| Coal .....0 3                          |   |                     |        |
| Slate binder...0 3                     |   |                     |        |
| Coal .....0 3                          |   |                     |        |
| Slate, dark.....                       | 1 8   | 474 1               |        |
| Fire clay.....                         | 2 0   | 476 1               |        |
| Slate, dark.....                       | 7 6   | 483 7               |        |
| Coal, Lower Sewickley.....             | 0 2   | 483 9               | 11.3'  |
| Fire clay.....                         | 4 8   | 488 5               |        |
| Shale, sandy.....                      | 7 0   | 495 5               |        |
| Fire clay.....                         | 7 2   | 502 7               |        |
| Shale, dark.....                       | 15 0  | 517 7               |        |
| Coal, Redstone.....                    | 0 11  | 518 6               | 34.7'  |
| Fire clay, slaty.....                  | 5 0   | 523 6               |        |
| Lime, Redstone.....                    | 23 5  | 546 11              |        |
| Sandy fire clay.....10' 5"             | } Upper Pittsburgh Sandstone                                      | 30 9                | 577 8  |
| Sandy fire clay with lime streaks.18 0 |   |                     |        |
| Sand ..... 2 4                         |   |                     |        |
| Slate, dark.....                       | 13 2  | 590 10              |        |
| Coal .....0' 9"                        | } Pittsburgh coal.... 10 0<br>(Elevation of base, 700.41'L-A. T.) | 600 10              | 82.3'  |
| Slate, black...0 3                     |   |                     |        |
| Coal .....3 9                          |   |                     |        |
| Binder ...0 0½                         |   |                     |        |
| Coal .....0 6½                         |   |                     |        |
| Binder ...0 1                          |   |                     |        |
| Coal .....4 7                          |   |                     |        |
| <b>Conemaugh Series (1' 7")</b>        |   |                     |        |
| Fire clay to bottom of hole.....       | 1 7   | 602 5               |        |

The composition of the Sewickley coal, as reported by the company, is given on a subsequent page under the discussion of the bed.

GRANT DISTRICT.—Grant district, Marion county, occupies all that portion of the latter area lying south of the West Fork river and southwest of the Tygart Valley river: hence, the outcropping rocks in this district are confined to the Dunkard, Monongahela, Conemaugh and Allegheny series. The following hand-leveled section was measured by D. B. Reger along the northwestern border of the district westward from the summit of what is known as the "Watson Knob" to Booths creek at the Wm. Watson No. 1 well (674), located

0.5 mile southeast of Monongah. Owing to a dip of 50 to 70 feet in the measures in the opposite direction from that in which the section was measured, the thicknesses of formations and intervals are slightly greater than they should be:

**Section ½ Mile Southeast of Monongah, Grant District.**

| <i>Upper Carboniferous (456')</i>   | Thickness. Total. |       |      |
|---|-------------------|-------|------|
|   | Feet.             | Feet. |      |
| <b>Dunkard Series (25')</b>   |                   |       |      |
| Sandstone, coarse, brown, soft and pebbly,<br>"Watson Knob" in lone column, <b>Waynes-</b><br><b>burg</b> ..... | 25                | 25    | 25'  |
| <b>Monongahela Series (431')</b>  |                   |       |      |
| Slate, black, coaly streak, <b>Waynesburg</b> ....  | 0                 | 25    |      |
| Concealed .....   | 116               | 141   |      |
| <b>Sandstone, green, flaggy, fine grained,</b><br><b>Uniontown</b> .....  | 41.7              | 182.7 |      |
| Slate, black (3").....  | 0.3               | 183   | 158' |
| Concealed .....   | 51                | 234   |      |
| Limestone, with shale layers, <b>Benwood</b> ....   | 71                | 305   |      |
| Concealed .....   | 19.5              | 324.5 |      |
| Coal, <b>Sewickley</b> .....  | 3.5               | 328   | 145' |
| Concealed .....   | 4                 | 332   |      |
| Sandstone .....   | 7                 | 339   |      |
| Shale and concealed.....  | 16                | 355   |      |
| Sandstone, limy.....  | 12                | 367   |      |
| Shale, gray.....  | 1.7               | 368.7 |      |
| Slate, black (3").....  | 0.3               | 369   |      |
| Limestone, hard.....  | 11                | 380   |      |
| Shale, silicious.....   | 16.8              | 396.8 |      |
| <b>Black slate, Redstone coal horizon</b> .....   | 0.2               | 397   | 69'  |
| Shale and concealed.....  | 20                | 417   |      |
| Limestone, hard, <b>Redstone</b> .....  | 12                | 429   |      |
| Sandstone, gray, <b>Upper Pittsburgh</b> .....  | 10                | 439   |      |
| Shale, gray to well mouth of Wm. Watson<br>No. 1 (674).....   | 3                 | 442   |      |
| Shale, gray.....  | 6                 | 448   |      |
| Coal, <b>Pittsburgh</b> , to bed of Booth's creek..   | 8                 | 456   | 57'  |

For the rock succession in the southern point of Grant district, the reader is referred to the Boothsville section, published on pages 109-110 of the Doddridge-Harrison Report of the State Survey.

**WINFIELD DISTRICT.**—Winfield district occupies the north portion of that part of Marion county lying on the east side of the Monongahela river; hence, its outcropping rocks are confined to the Monongahela, Conemaugh, Allegheny, and Pottsville series.

The following section was obtained along the north-

western border of Winfield district from the log of the A. Boutlou No. 1 well (666), located on the south side of the Monongahela river one mile westward from Montana Mines. This well was drilled during 1912, and the record kindly furnished the Survey by Anthony Bowen of Fairmont:

**Montana Mines Section, Winfield District.**

| (A. Boutlou No. 1 Well Record (666).)                            |            |        |      |
|--|------------|--------|------|
| <i>Upper Carboniferous (1340')</i>                               | Thickness. | Total. |      |
| <b>Monongahela Series (243')</b>                                 | Feet.      | Feet.  |      |
| Unrecorded .....   | 235        | 235    |      |
| Pittsburgh coal.....   | 8          | 243    | 243' |
| <b>Conemaugh Series (607')</b>                                   |            |        |      |
| Unrecorded .....   | 242        | 485    |      |
| Sand, (Grafton).....   | 25         | 510    |      |
| Unrecorded .....   | 126        | 636    |      |
| Sand, Little Dunkard? (Saltsburg).....                           | 10         | 646    |      |
| Unrecorded .....   | 139        | 785    |      |
| Sand, Big Dunkard..25' } (Mahoning).....                         | 65         | 850    | 204' |
| Unrecorded .....   | 25         |        |      |
| Sand .....   | 15         |        |      |
| <b>Allegheny Series (230')</b>                                   |            |        |      |
| Unrecorded .....   | 100        | 950    |      |
| Gas sand (Lower Freeport).....                                   | 70         | 1020   |      |
| Coal, (Lower Kittanning).....                                    | 5          | 1025   | 175' |
| Unrecorded .....   | 55         | 1080   | 55'  |
| <b>Pottsville Series (260')</b>                                  |            |        |      |
| Sand, First Salt? (I Cow Run) (Homewood)                         | 30         | 1110   |      |
| Unrecorded .....   | 10         | 1120   |      |
| Sand, Second Salt? (Upper Connoquenessing)                       | 30         | 1150   |      |
| Unrecorded .....   | 45         | 1195   |      |
| Sand, bottom streak (little water) (Lower Connoquenessing) ..... | 50         | 1245   |      |
| Unrecorded .....   | 10         | 1255   |      |
| Sand, (Sharon).....  | 85         | 1340   | 260' |
| <i>Lower Carboniferous (683')</i>                                |            |        |      |
| <b>Mauch Chunk Series (250')</b>                                 |            |        |      |
| Unrecorded .....   | 50         | 1390   |      |
| Red rock.....  | 60         | 1450   |      |
| Limestone .....  | 20         | 1470   |      |
| Red rock.....  | 30         | 1500   |      |
| Slate .....  | 40         | 1540   |      |
| Limestone .....  | 15         | 1555   |      |
| Red rock.....  | 10         | 1565   |      |
| Limestone .....  | 10         | 1575   |      |
| Pencil cave.....   | 15         | 1590   | 250' |
| <b>Greenbrier Limestone (68')</b>                                |            |        |      |
| Big Lime.....  | 64         | 1654   |      |
| Red rock (not real red).....                                     | 4          | 1658   | 68'  |
| <b>Pocono Sandstones (365')</b>                                  |            |        |      |
| Big Injun sand.....  | 107        | 1765   |      |
| Slate .....  | 78         | 1843   |      |

|   | Thickness. | Total. |      |
|---|------------|--------|------|
|   | Feet.      | Feet.  |      |
| Squaw sand (fairly good).....   | 57         | 1900   |      |
| Slate and shale.....  | 65         | 1965   |      |
| Berea Grit sand (hard, limy).....   | 35         | 2000   |      |
| Slate .....   | 8          | 2008   |      |
| Sand, hard (15 feet good sand).....   | 15         | 2023   |      |
| <i>Devonian (1484')</i>   |            |        |      |
| <b>Catskill Sandstones (800')</b>   |            |        |      |
| Slate and shale (hard, limy).....   | 112        | 2135   |      |
| Fifty-foot sand (very hard, show of gas at<br>2180') .....                              | 75         | 2210   |      |
| Slate and shales, hard, sandy.....  | 80         | 2290   |      |
| Red rock and shells.....  | 15         | 2305   |      |
| Sand, Gordon Stray.....   | 28         | 2333   |      |
| Red rock.....   | 27         | 2360   |      |
| Gordon sand.....  | 17         | 2377   |      |
| Red rock (formation shelly. At Fourth sand<br>horizon found red sandy shales, hard).... | 223        | 2600   | 577' |
| Fifth sand.....   | 17         | 2617   |      |
| Slate .....   | 37         | 2654   |      |
| Bayard sand.....  | 52         | 2706   |      |
| Slate .....   | 17         | 2723   | 223' |
| <b>Chemung Series (684')</b>  |            |        |      |
| Slate, shells and limestones, sometimes<br>gritty, but no clear indication of sand....  | 684        | 3507   | 684' |
| 10 inch casing 284'; 8¼ inch casing, 1248'; 6½ inch casing,<br>1697½'.                  |            |        |      |

The rock succession along the eastern border of Winfield district is well illustrated by the log of the Brent S. Jones No. 1 well (682A), published on pages 151-152 of Vol. I(A) of the State Survey reports. This well is located on the west bank of Whiteday creek, 1.5 miles due south of Whiteday (Smithtown). The Harlem coal crops in the hill to the southwest, 285 feet by aneroid above the well, and the Upper Freeport coal about 15 feet above the top of the hole; hence, the correlations of the coals as published in the reference above given should be corrected accordingly.

**UNION DISTRICT.**—Union district, Marion county, occupies the southern portion of that part of the latter area east of the Monongahela and Tygart Valley rivers; hence, the cropping rocks therein are confined entirely to the Monongahela, Conemaugh, Allegheny, and Pottsville series.

On page 636 of Vol. II(A) of the State Survey reports, I. C. White gives an interesting partial section of the Conemaugh measures for the western border of the district. This section was measured on the river hill, one-half mile below Colfax.

The following hand-leveled section was measured along the southern border of the district from the summit of a knob, located 0.6 mile northeast of Powell station, southeastward to Tygart Valley river. That portion above the base of the Allegheny series was measured on a very steep slope on the rise of the strata; hence, the thicknesses of formations and intervals, and of the latter measures are slightly less than they should be. The figures for the Pottsville are very close the facts, since they represent almost vertical measurements, and were determined from exposures along the B. & O. railroad grade about one-half mile northwest of Hammond. Two well known fossiliferous (marine) Conemaugh formations are present; viz., the **Pine Creek limestone** and the **Brush Creek shale**, and these help very materially to identify positively the base of the latter series. The section differs somewhat from that of I. C. White, published on pages 571-572 of Vol. II(A) of the State Survey reports. The discrepancies are probably caused largely by the more accurate measurement with hand-level than with aneroid, and by observations on different exposures of the same formations:

**Section 1/2 Mile Northeast of Powell, Union District.**

| <i>Upper Carboniferous:</i>                                       | Thickness.                 | Total     |            |
|---|----------------------------|-----------|------------|
| <b>Conemaugh Series (177')</b>                                    | Feet.                      | Feet.     |            |
| Concealed with yellowish sandy shale from top of knob.....        | 47                         | 47        |            |
| <b>Limestone, silicious, many marine fossils, Pine Creek.....</b> | <b>2</b>                   | <b>49</b> | <b>49'</b> |
| Sandstone, shaly, green, forms cliff.....16'                      | } <b>Buffalo Sandstone</b> | 56        | 105        |
| Shale, gray and sandy... 5  |                            |           |            |
| Sandstone, shaly, and sandy shale.....35                          |                            |           |            |
| Concealed and dark shale.....                                     | 5                          | 110       |            |
| Shale, dark, full of marine fossils .....0' 2" }                  | } <b>Brush Creek Shale</b> | 1         | 111        |
| Slate, black (6").....0 10  |                            |           |            |
| Coal, Brush Creek, 8" to.....                                     | 1                          | 112       | <b>63'</b> |
| Fire clay and gray shale.....                                     | 5                          | 117       |            |
| Sandstone, massive, great cliff, Mahoning..                       | 60                         | 177       | <b>65'</b> |
| <b>Allegheny Series (226')</b>                                    |                            |           |            |
| Coal blossom, with black slate, Upper Freeport coal horizon.....  | 1                          | 178       |            |
| Fire clay and concealed.....                                      | 8                          | 186       |            |



|   | Thickness.<br>Feet. | Total.<br>Feet. |                     |
|---|---------------------|-----------------|---------------------|
| Sandstone, massive, coarse<br>and pebbly .....  | 34.7                |                 | } Upper<br>Freeport |
| Coal (4"), local .....  | 0.3                 |                 |                     |
| Sandstone, massive, coarse<br>pebbly .....  | 15                  |                 | } Sandstone         |
| Concealed with coal blossom at base, Lower<br>Freeport coal.....                              | 5                   | 241             |                     |
| Concealed .....   | 4                   | 245             |                     |
| Sandstone, green, shaly, Lower Freeport....   | 15                  | 260             |                     |
| Concealed .....   | 10                  | 270             |                     |
| Sandstone, green, flaggy and shaly, Lower<br>Freeport .....                                   | 25                  | 295             |                     |
| Coal, Upper Kittanning.....   | 3                   | 298             | 121                 |
| Fire clay .....   | 5                   | 303             |                     |
| Sandstone, massive, or micaceous, Lower<br>Freeport .....                                     | 25                  | 328             |                     |
| Concealed .....   | 7                   | 335             |                     |
| Shale, silicious, with thin sandstone.....  | 10                  | 345             |                     |
| Slate, dark gray.....   | 10                  | 355             |                     |
| Cannel slate...0' 6" }<br>Coal, bony.....0 6 }<br>Coal, slaty.....2 4 } Lower Kittanning coal | 5                   | 360             | 62'                 |
| Coal, bony.....0 8 }<br>Coal, soft.....1 0 }  |                     |                 |                     |
| Fire clay and concealed.....  | 26                  | 386             |                     |
| Sandstone, flaggy.....  | 3                   | 389             |                     |
| Shale, sandy.....   | 3                   | 392             |                     |
| Coal .....1' 1" }<br>Shale, gray....0 1 } (3' 2") Clarion.....                                | 3                   | 395             |                     |
| Coal .....2 0 }   |                     |                 |                     |
| Slate, black.....   | 2                   | 397             |                     |
| Fire clay and concealed.....  | 6                   | 403             | 43'                 |
| <b>Pottsville Series (199')</b>   |                     |                 |                     |
| Sandstone, massive, pebbly, white, Homewood   | 36                  | 439             |                     |
| Fire clay.....  | 2                   | 441             |                     |
| Coal, Tionesta.....   | 2                   | 443             | 40'                 |
| Fire clay, medium hard.....   | 6                   | 449             |                     |
| Shale, sandy, laminated with iron ore nuggets.  | 31                  | 480             |                     |
| Coal, soft (8").....  | 1                   | 481             |                     |
| Fire clay and shale.....  | 15                  | 496             |                     |
| Coal, bony (2").....  | 0                   | 496             |                     |
| Fire clay, flinty, Hammond, 4 feet to.....  | 1                   | 497             |                     |
| Shale, black, 4 feet to.....  | 0                   | 497             |                     |
| Coal, bony...2' 0" }<br>Slate, black..0 2 }<br>Coal, soft....2 3 } (5' 5") Upper Mercer       | 5.4                 | 502.4           | 59.4'               |
| Slate, black..0 2 }   |                     |                 |                     |
| Coal, blocky..0 10 }  |                     |                 |                     |
| Fire clay, medium hard.....   | 3                   | 505.4           |                     |
| Sandstone, flaggy and dark.....   | 4                   | 509.4           |                     |
| Shale, sandy and hard.....  | 5                   | 514.4           |                     |
| Shale, sandy and soft.....  | 5                   | 519.4           |                     |
| Limestone, ferriferous, hard, Lower Mer-<br>cer (6").....                                     | 0.5                 | 519.9           |                     |
| Shale, gray.....  | 1                   | 520.9           |                     |

|  | Thickness. | Total. |       |
|--|------------|--------|-------|
|  | Feet.      | Feet.  |       |
| Slate, black...2' 0" } Lower Mercer coal...  | 2.1        | 523    |       |
| Coal .....0 2 }  |            |        |       |
| Fire clay, hard, good.....   | 4          | 527    |       |
| Shale .....  | 5          | 532    | 29.6' |
| Sandstone, massive, white, conglomeratic, pebbly, making falls in river at Valley Falls, and penetrated by water well there 70' without reaching bottom of sandstone, Upper Connoquenessing..... | 70         | 602    | 70'   |

The section also shows that the flint fire clay, mined at Hammond by the Hammond Fire Brick Company, belongs immediately above the Upper Mercer coal.

### TAYLOR COUNTY SECTIONS.

**BOOTH'S CREEK DISTRICT.**—Booths Creek district occupies the northwestern corner of Taylor county; hence, the outcropping rocks therein belong in the Monongahela, Conemaugh, Allegheny and Pottsville series. On page 109 of the Doddridge-Harrison report of the State Survey the writer gave a section for the Boothsville region of this district.

The following aneroid section was measured by D. B. Reger in the southwestern corner of Booths Creek district from the summit of Patton Knob, located 0.5 mile southwest of Meadland, northwestward along the hill road:

#### Section ½ Mile West of Meadland, Booths Creek District

|   | Thickness. | Total. |      |
|---|------------|--------|------|
|   | Feet.      | Feet.  |      |
| <i>Upper Carboniferous (495')</i>                         |            |        |      |
| <b>Monongahela Series (100')</b>                          |            |        |      |
| Sandstone, capping "Patton Knob" (See Map II).....        | 5          | 5      |      |
| Concealed .....   | 20         | 25     |      |
| Limestone, good, Sewickley.....                           | 5          | 30     |      |
| Concealed .....   | 40         | 70     |      |
| Sandstone, shaly.....                                     | 5          | 75     |      |
| Concealed .....   | 18         | 93     |      |
| Coal, Pittsburgh (Elevation of base, 1571' L.-A. T.)..... | 7          | 100    | 100' |
| <b>Conemaugh Series (395')</b>                            |            |        |      |
| Concealed .....   | 14         | 114    |      |
| Coal, Little Pittsburgh.....                              | 1          | 115    |      |
| Concealed, sandstone and concealed.....                   | 15         | 130    |      |
| Coal streak.....  | 0          | 130    |      |
| Shale and concealed.....                                  | 25         | 155    |      |
| Slate .....   | 1          | 156    |      |
| Shale, variegated.....                                    | 19         | 175    |      |
| Limestone, shaly.....                                     | 5          | 180    |      |

|  | Thickness. |             |      |
|--|------------|-------------|------|
|  | Feet.      | Total Feet. |      |
| Shale, sandy.....                            | 15         | 195         |      |
| Sandstone .....                              | 5          | 200         |      |
| Shale and concealed.....                     | 20         | 220         |      |
| Coal, streak, Little Clarksburg.....         | 0          | 220         | 120' |
| Concealed and shale.....                     | 25         | 245         |      |
| Limestone, Clarksburg.....                   | 5          | 250         |      |
| Concealed and red shale.....                 | 55         | 305         |      |
| Shale, brown.....                            | 15         | 320         |      |
| Coal streak, Elk Lick?.....                  | 0          | 320         |      |
| Concealed .....                              | 40         | 360         |      |
| Shale, dark green, marine, fossils, Ames.... | 10         | 370         | 150' |
| Concealed and red shale, "Pittsburgh Reds"   | 45         | 415         |      |
| Sandstone, shaly.....                        | 35         | 450         |      |
| Concealed with shale to foot of hill.....    | 45         | 495         | 125' |

FLEMINGTON DISTRICT.—Flemington district occupies the southwestern portion of Taylor county; hence, the outcropping rocks therein belong in the Monongahela and Conemaugh series exclusively. On the southwestern border of the district, D. B. Reger measured the following hand-leveled section from the summit of the high knob, located 0.6 mile southwest of Tyrconnell Mines, northeastward to railroad grade at the latter place. The section is important, in that it gives an accurate measurement of the interval between the Pittsburgh and Harlem coals:

#### Tyrconnell Mines Section, Flemington District.

| <i>Upper Carboniferous (615')</i>                                   | Thickness. |             |      |
|---|------------|-------------|------|
|   | Feet.      | Total Feet. |      |
| <b>Monongahela Series (274')</b>                                    |            |             |      |
| Shale, sandy, capping knob.....                                     | 27         | 27          |      |
| Sandstone, hard, green, flaggy, fine grained<br>(Arnoldsburg) ..... | 33         | 60          | 60   |
| Concealed .....   | 8          | 68          |      |
| Limestone .....   | 1          | 69          |      |
| Concealed .....   | 60         | 129         |      |
| Sandstone, shaly.....   | 10         | 139         |      |
| Shale, brown.....   | 3          | 142         |      |
| Limestone, good (Benwood).....                                      | 6          | 148         |      |
| Shale, limy.....  | 17         | 165         |      |
| Shale, brown.....   | 5          | 170         |      |
| Sandstone fine, green, flaggy.....                                  | 8          | 178         |      |
| Concealed .....   | 9          | 187         |      |
| Sandstone, (Lower Sewickley).....                                   | 24         | 211         |      |
| Concealed .....   | 60         | 271         |      |
| Sandstone, shaly, (Upper Pittsburgh).....                           | 3          | 274         |      |
| Coal, Pittsburgh.....   | 8          | 282         | 222' |
| <b>Conemaugh Series (333')</b>                                      |            |             |      |
| Concealed .....   | 11         | 293         |      |

|   | Thickness. | Total. |      |
|---|------------|--------|------|
|   | Feet.      | Feet.  |      |
| Sandstone, shaly, Lower Pittsburgh.....                   | 28         | 321    |      |
| Concealed and shale.....                                  | 17         | 338    |      |
| Concealed .....   | 77         | 415    |      |
| Coal streak.....  | 0          | 415    |      |
| Concealed and shale.....                                  | 17.5       | 432.5  |      |
| Coal, Little Clarksburg.....                              | 0.5        | 433    | 151' |
| Shale, yellow.....  | 5          | 438    |      |
| Concealed .....   | 44         | 482    |      |
| Sandstone, light brown and hard, (Morgan-<br>town) .....  | 24         | 506    |      |
| Concealed, mostly fire clay.....                          | 2          | 508    | 75'  |
| Shale, red.....   | 14         | 522    |      |
| Sandstone, shaly.....                                     | 8          | 530    |      |
| Concealed and red shale.....                              | 28         | 558    |      |
| Sandstone, Grafton.....                                   | 15         | 573    |      |
| Shale, green.....   | 18         | 591    |      |
| Limestone, marine fossils, Lower Ames.....                | 1          | 592    |      |
| Shale .....   | 4          | 596    |      |
| Coal, Harlem.....   | 1          | 597    | 89'  |
| Shale, red, Pittsburgh.....                               | 8          | 605    |      |
| Sandstone, shaly to railroad grade at Rose-<br>mont ..... | 10         | 615    | 18'  |

A fine section of the underground rocks on the eastern border of Flemington district is revealed in the log of the **Pittsvein Coal Company well (713)**, located 0.5 mile northeast of Flemington, the record of which is published on pages 340-342 of Volume I(A) of the State Survey reports. The well penetrates the Devonian rocks a distance of slightly over 1000 feet.

**COURTHOUSE DISTRICT.**—Courthouse district, Taylor county, lies between Flemington district and the Valley river; hence, the outcropping rocks therein belong in the Monongahela, Conemaugh, Allegheny, and Pottsville series.

The following section was obtained for the eastern border of Courthouse district by combining hand-leveled sections measured by D. B. Reger with the log of the A. J. Bartlett Diamond Drill Boring (719), the record of which was published on pages 573-574 of Vol. II(A) of the State Survey reports. That portion of the section above the base of the Conellsville sandstone was measured from the summit of the high knob located about one mile south 25° west of the boring; and that portion from the base of the same sandstone down to the well mouth, was measured on the steep hill slope immediately west of the well:

## Section at Webster, Courthouse District.

| <i>Upper Carboniferous (973')</i>  | Thickness. |    | Total. |    |         |
|--|------------|----|--------|----|---------|
|  | Ft. In.    |    |        |    | Ft. In. |
| <b>Monongahela Series (52')</b>  |            |    |        |    |         |
| Concealed from summit of knob 1.1 miles S 25° W of boring (719).....             | 15         | 0  | 15     | 0  |         |
| Coal streak, Redstone.....   | 0          | 0  | 15     | 0  |         |
| Limestone, yellow, Redstone.....   | 1          | 0  | 16     | 0  |         |
| Concealed .....  | 23         | 0  | 39     | 0  |         |
| Slate .....  | 4          | 0  | 43     | 0  |         |
| Coal, Pittsburgh.....  | 9          | 0  | 52     | 0  | 52'     |
| <b>Conemaugh Series (559')</b>   |            |    |        |    |         |
| Concealed .....  | 98         | 0  | 150    | 0  |         |
| Sandstone, massive, brown, very coarse and pebbly, making cliff, Conneville..... | 27         | 0  | 177    | 0  | 125'    |
| Concealed .....  | 12         | 0  | 189    | 0  |         |
| Sandstone .....  | 6          | 0  | 195    | 0  |         |
| Concealed .....  | 132        | 0  | 327    | 0  |         |
| Shale, brown and sandy.....  | 15         | 0  | 342    | 0  |         |
| Shale, dark, marine fossils, Ames....  | 6          | 0  | 348    | 0  |         |
| Concealed and shale.....   | 7          | 6  | 355    | 6  |         |
| Coal, Harlem (Elevation of base. 1120' L-A. T.).....                             | 1          | 6  | 357    | 0  | 180'    |
| Shale, limy.....   | 14         | 0  | 371    | 0  |         |
| Limestone, silicious, Ewing.....   | 10         | 0  | 381    | 0  |         |
| Shale, limy.....   | 5          | 0  | 386    | 0  |         |
| Sandstone, shaly.....  | 6          | 0  | 392    | 0  |         |
| Shale .....  | 5          | 0  | 397    | 0  |         |
| Sandstone, shaly.....  | 11         | 0  | 408    | 0  |         |
| Concealed .....  | 13         | 0  | 421    | 0  |         |
| Sandstone, green, fine.....  | 5          | 0  | 426    | 0  |         |
| Concealed .....  | 22         | 0  | 448    | 0  |         |
| Sandstone .....  | 10         | 0  | 458    | 0  |         |
| Concealed to top of boring (719).....  | 13         | 0  | 471    | 0  | 114'    |
| <b>A. J. Bartlett Boring Record (719)</b>  |            |    |        |    |         |
| (Elevation of well mouth. 1006' L-A. T.)   |            |    |        |    |         |
| Yellow clay and gravel.....  | 10         | 6  | 481    | 6  |         |
| Fire clay and shale.....   | 6          | 4  | 487    | 10 |         |
| Shale .....  | 14         | 10 | 502    | 8  |         |
| Shale, limy.....   | 8          | 0  | 510    | 8  |         |
| Fire clay and black shale, Brush Creek   | 2          | 10 | 513    | 6  |         |
| Coal, Brush Creek.....   | 0          | 9  | 514    | 3  | 43.3'   |
| Limestone, impure.....   | 12         | 11 | 527    | 2  |         |
| Fire clay.....   | 11         | 6  | 538    | 8  |         |
| Shale, light green.....  | 7          | 0  | 545    | 8  |         |
| Fire clay.....   | 17         | 6  | 563    | 2  |         |
| Sandy shale and sandstone, massive..   | 32         | 3  | 595    | 5  |         |
| Shale, sandy.....  | 15         | 7  | 611    | 0  | 96.7'   |
| <b>Allegheny Series (181.2')</b>   |            |    |        |    |         |
| Fire clay and shale.....   | 7          | 3  | 618    | 3  |         |
| Shale, sandy.....  | 5          | 0  | 623    | 3  |         |
| Shale, streaked with coal seams....  | 11         | 0  | 634    | 3  |         |
| Coal, Lower Freeport.....  | 2          | 0  | 636    | 3  | 25.2'   |
| Fire clay and sandy shale.....   | 19         | 11 | 656    | 2  |         |
| Limestone, dark, greenish gray, Lower Freeport.....                              | 7          | 0  | 663    | 2  |         |

|   | Thickness. |     | Total. |     |                                       |
|---|------------|-----|--------|-----|---------------------------------------|
|   | Feet.      | In. | Feet.  | In. |                                       |
| Shale and fire clay with lime nodules.                                    | 14         | 0   | 677    | 2   |                                       |
| Sandy shale and micaceous sandstone                                       | 12         | 1   | 688    | 3   |                                       |
| Coal .....0' 1"   |            |     |        |     | } Upper Kittanning.                   |
| Black slate.0 2   |            |     |        |     |                                       |
| Coal .....0 4   |            |     |        |     |                                       |
| Gray slate..1 2   |            |     |        |     |                                       |
| Black slate.1 6   |            |     |        |     |                                       |
| Coal .....1 6   |            |     |        |     |                                       |
| Dark slate and sandy shale.....   | 13         | 4   | 706    | 4   |                                       |
| Limestone, Johnstown Cement Bed...  | 9          | 6   | 715    | 10  |                                       |
| Shale .....   | 10         | 0   | 725    | 10  |                                       |
| Black slate, thin seams of coal.....                                      | 2          | 0   | 727    | 10  |                                       |
| Fire clay.....  | 2          | 4   | 730    | 2   |                                       |
| Shale, sandy.....   | 6          | 10  | 737    | 0   |                                       |
| Coal .....0' 2"   |            |     |        |     | } Roaring Creek,<br>Lower Kittanning. |
| Black slate.1 2   |            |     |        |     |                                       |
| Bony coal..0 2  |            |     |        |     |                                       |
| Coal .....2 4   |            |     |        |     |                                       |
| Bony coal..0 4  |            |     |        |     |                                       |
| Coal .....1 8   |            |     |        |     |                                       |
| Fire clay, hard (Lower Kittanning) ..                                     | 6          | 0   | 748    | 10  |                                       |
| Shale, sandy, some limestone.....   | 4          | 0   | 752    | 10  |                                       |
| Sand, hard, massive, light gray,<br>Clarion .....                         | 27         | 4   | 780    | 2   |                                       |
| Sand, or sandy sha'e, dark.....   | 12         | 0   | 792    | 2   | 49.3'                                 |
| <b>Pottsville Series (180.8')</b>   |            |     |        |     |                                       |
| Sand, hard, base pebbly coal streaks<br>in center, Homewood-Roaring Creek | 39         | 0   | 831    | 2   |                                       |
| Sand and sandy shale.....   | 31         | 10  | 863    | 0   |                                       |
| Sand, hard, white, pebbly, Upper<br>Connoquenessing .....                 | 60         | 0   | 923    | 0   |                                       |
| Dark sandstone with coal seams,<br>Quakertown .....                       | 3          | 0   | 926    | 0   |                                       |
| Sandstone, very hard oonglomerate,<br>Lower Connoquenessing to bottom..   | 47         | 0   | 973    | 0   | 180.8'                                |

Owing to the dip of the strata to the northwest, the intervals and thicknesses of formations from the base of the Connelsville down to the top of the boring at 471' are slightly less than they should be.

FETTERMAN DISTRICT.—Fetterman district occupies the northeastern portion of Taylor county; hence, the outcropping rocks therein belong in the Conemaugh, Allegheny and Pottsville series.

The following hand-leveled section was measured at the southern edge of Fetterman district southward from the summit of the hill located on the Grafton-Fetterman district line, 0.3 mile north of the mouth of Threeforks creek, to the level of Tygart Valley river, 0.2 mile below the mouth of the former

stream. The portion including the basal 20' of the Conemaugh and the Allegheny series, was measured one mile eastward on the same stream:

### Grafton Section.

|  | Thickness. | Total. |        |
|--|------------|--------|--------|
|  | Feet.      | Feet.  |        |
| <i>Upper Carboniferous (404')</i>  |            |        |        |
| <b>Conemaugh Series (334')</b>   |            |        |        |
| Sandstone, Grafton, capping knob, coarse brown and pebbly.....                         | 35         | 35     |        |
| Concealed .....  | 4.5        | 39.5   |        |
| Shale, dark green, marine fossils, Ames....  | 14         | 53.5   |        |
| Coal, Harlem (elevation, 1235' L.-A. T.).....  | 1          | 54.5   | 54.5'  |
| Shale, red and variegated ("Pittsburgh Reds") .....                                    | 34         | 88.5   |        |
| Sandstone, coarse brown and soft, Saltsburg  | 27         | 115.5  |        |
| Fire clay (Bakerstown coal horizon).....   | 1          | 116.5  | 62'    |
| Shale, yellowish.....  | 17         | 133.5  |        |
| Concealed .....  | 55.5       | 189    |        |
| Sandstone, coarse, gray, massive, Buffalo..  | 55         | 244    |        |
| Shale, dark, plant and marine fossils, Brush Creek .....                               | 6.5        | 250.5  |        |
| Coal, Brush Creek.....   | 0.5        | 251    | 134.5' |
| Fire clay shale, gray.....   | 6          | 257    |        |
| Sandstone, shaly.....  | 11         | 268    |        |
| Sandstone, flaggy, brown, medium grained, Upper Mahoning.....                          | 17         | 285    |        |
| Shale, yellow, with iron ore nuggets.....  | 5          | 290    |        |
| Concealed to river ¼ mile west of mouth of Threeforks creek.....                       | 24         | 314    |        |
| Concealed (1.2 miles to the eastward).....   | 20         | 334    | 83'    |
| <b>Allegheny Series (70')</b>  |            |        |        |
| Concealed .....  | 10         | 344    |        |
| Sandstone, gray, massive, with iron oxide streaks, Upper Freeport.....                 | 43         | 387    |        |
| Shale, sandy.....  | 3          | 390    |        |
| Slate, dark.....   | 2          | 392    |        |
| Coal ..... 1' 3" )   |            |        |        |
| Shale, gray.... 0 1 } Lower Freeport coal..  | 2          | 394    | 60'    |
| Coal ..... 0 8 }   |            |        |        |
| Fire clay shale.....   | 5          | 399    |        |
| Shale, sandy, to bed of Threeforks creek, one mile east of mouth of latter stream..... | 5          | 404    | 10'    |

The following aneroid section was measured in the extreme northeast corner of Fetterman district, Taylor county, southwestward mostly along the hill road to the bed of Laurel run from the summit of the high knob located 0.4 mile northeast of the common corner to Taylor, Monongalia and Preston counties. Owing to the rapid dip of the strata to the south-

east, the intervals and thicknesses of formations are much greater in portions of the section than they should be, but the succession as shown is believed to be correct:

**Section One Mile Northwest of Irondale, Fetterman District.**

| <i>Upper Carboniferous (670')</i>   | Thickness. Total. |       |      |
|---|-------------------|-------|------|
| <b>Conemaugh Series (390')</b>  | Feet.             | Feet. |      |
| Sandstone, Grafton, large quartz pebbles capping knob.....  | 30                | 30    |      |
| Concealed and shale, dark green, Ames, marine fossils.....  | 13.5              | 43.5  |      |
| Coal, Harlem (18").....   | 1.5               | 45    | 45'  |
| Concealed, with pebbly sandstone (Saltsburg) at base.....   | 60                | 105   |      |
| Concealed .....   | 80                | 185   |      |
| Sandstone, massive, coarse and pebbly, Buffalo .....  | 105               | 290   | 245' |
| Shale, sandy.....   | 2                 | 292   |      |
| Slate, black (Brush Creek).....   | 3                 | 295   |      |
| Concealed with reds near base.....  | 60                | 355   |      |
| Sandstone medium grained, Mahoning.....   | 35                | 390   | 100' |
| <b>Allegheny Series (270')</b>  |                   |       |      |
| Concealed (mostly sandstone).....   | 75                | 465   |      |
| Concealed .....   | 26                | 491   |      |
| Coal opening, fallen shut, Upper Kittanning   | 4                 | 495   | 105' |
| Concealed .....   | 39                | 534   |      |
| Black slate.....  | 1                 | 535   |      |
| Fire clay.....  | 5                 | 540   |      |
| Shale, sandy and shaly sandstone.....   | 30                | 570   |      |
| Concealed .....   | 31.3              | 601.3 |      |
| Coal .....  | 0' 8"             |       |      |
| Shale, gray.....  | 2 0               |       |      |
| Coal .....  | 0 11              |       |      |
| Slate, gray and hard .....  | 0 5               |       |      |
| Coal, bony.....   | 0 7               |       |      |
| Slate, black.....   | 0 11              |       |      |
| Coal, soft .....  | 2 3               |       |      |
| Slate, black.....   | 0 6               |       |      |
| Coal, bony .....  | 0 6               |       |      |
| Fire clay and concealed.....  | 19                | 629   |      |
| Coal blossom, Clarion (1330' L-A.T.).....   | 6                 | 635   |      |
| Concealed .....   | 25                | 660   | 50'  |
| <b>Pottsville Series (10')</b>  |                   |       |      |
| Sandstone, massive, Homewood, to bed of Laurel run at road forks, 1 mile northwest of Irondale..... | 10                | 670   | 10'  |

The following hand-leveled section was measured at the southeastern edge of Fetterman district by D. B. Reger south-westward from the summit of the high knob, located 0.5 mile northeast of Thornton, to the bed of Threeforks creek at the



plant of the Thornton Fire Brick Company at the latter town. The section shows that the clay quarried by the latter for brick manufacturing purposes comes immediately over the Upper Freeport coal bed and correlates with the Uffington Shale:

### Section at Thornton, Fetterman District.

| <i>Upper Carboniferous (599')</i>                                |  | Thickness. | Total. |     |
|--|--|------------|--------|-----|
| <b>Conemaugh Series (540')</b>                                   |  | Feet.      | Feet.  |     |
| Sandstone, soft, Lower Pittsburgh, capping knob .....            |  |            |        |     |
|  |  | 10         | 10     |     |
| Concealed and shale.....   |  |            |        |     |
|  |  | 36         | 46     |     |
| Sandstone, coarse, brown, Connellsville....                      |  |            |        |     |
|  |  | 50         | 96     |     |
| Coal streak, Clarksburg.....                                     |  |            |        |     |
|  |  | 0          | 96     | 96' |
| Concealed and red shale, Clarksburg.....                         |  |            |        |     |
|  |  | 33         | 129    |     |
| Concealed .....  |  |            |        |     |
|  |  | 55         | 184    |     |
| Fire clay (spring, water) (Elk Lick coal horizon) .....          |  |            |        |     |
|  |  | 1          | 185    | 89' |
| Shale, brown .....   |  |            |        |     |
|  |  | 15         | 200    |     |
| Concealed .....  |  |            |        |     |
|  |  | 22         | 222    |     |
| Sandstone, Grafton, mostly concealed.....                        |  |            |        |     |
|  |  | 37         | 259    |     |
| Concealed .....  |  |            |        |     |
|  |  | 17         | 276    |     |
| Shale, dark green, marine fossils, Ames....                      |  |            |        |     |
|  |  | 5          | 281    |     |
| Coal blossom, Harlem.....  |  |            |        |     |
|  |  | 0          | 281    | 96' |
| Shale, red, Pittsburgh.....                                      |  |            |        |     |
|  |  | 20         | 301    |     |
| Concealed .....  |  |            |        |     |
|  |  | 70         | 371    |     |
| Coal, Bakerstown (thickness concealed)....                       |  |            |        |     |
|  |  | 0          | 371    | 90' |
| Concealed .....  |  |            |        |     |
|  |  | 55         | 426    |     |
| Concealed, mostly sandstone (Buffalo)....                        |  |            |        |     |
|  |  | 38         | 464    |     |
| Coal, Brush Creek (thickness concealed)...                       |  |            |        |     |
|  |  | 0          | 464    | 93' |
| Concealed .....  |  |            |        |     |
|  |  | 2          | 466    |     |
| Sandstone, massive, Mahoning.....                                |  |            |        |     |
|  |  | 22         | 488    |     |
| Fire clay, shale brown .....                                     |  |            |        |     |
|  |  | 16'        |        |     |
| Fire clay, shale gray, plastic and flinty.....                   |  |            |        |     |
|  |  | 36         |        |     |
| } (Thornton fire clay) ..  |  |            |        |     |
|  |  | 52         | 540    | 76' |
| <b>Allegheny Series (59')</b>                                    |  |            |        |     |
| Coal, Upper Freeport (elevation, 1089' L-A. T.) 4 feet to.....   |  |            |        |     |
|  |  | 0.3        | 540.3  |     |
| Fire clay, gray, Bolivar.....                                    |  |            |        |     |
|  |  | 2.7        | 543    |     |
| Concealed .....  |  |            |        |     |
|  |  | 12         | 555    |     |
| Shale, gray, silicious and micaceous.....                        |  |            |        |     |
|  |  | 25         | 580    |     |
| Limestone, silicious, Upper Freeport.....                        |  |            |        |     |
|  |  | 3          | 583    |     |
| Shale, gray, with limestone nuggets.....                         |  |            |        |     |
|  |  | 10         | 593    |     |
| Concealed to Threeforks creek at northeast edge of Thornton..... |  |            |        |     |
|  |  | 6          | 599    | 59' |

**KNOTTSVILLE DISTRICT.**—Knottsville district occupies the southeastern corner of Taylor county; hence, its outcropping rocks belong in the Conemaugh, Allegheny, and Pottsville series. The following section was obtained in the

northern edge of the district by combining a hand-leveled section measured by D. B. Reger northeastward from the summit of a high knob located 0.4 mile southward from the mouth of Rocky branch, with the record of the shaft of the East Grafton Coal & Coke Company, the log of which was furnished by John Bailey, watchman for the latter company:

**Section 1.5 Miles Southwest of Thornton, Knottsville District.**

| <i>Upper Carboniferous (697')</i>                  | Thickness. | Total. |
|--|------------|--------|
| <b>Conemaugh Series (565')</b>                     | Feet.      | Feet.  |
| Unrecorded from top of knob 0.4 mile south-        |            |        |
| west of shaft.....                                 | 340        | 340    |
| Concealed .....                                    | 40         | 380    |
| Sandstone, shaly .....                             | 10         | 390    |
| Slate, black .....                                 | 1          | 391    |
| Coal .....0' 4 " } (2' 8¼") Bakerstown             | 3          | 394    |
| Slate .....0 0¼ } Elevation, 1203'                 |            |        |
| Coal, good...2 4 } L-A. T.)                        |            |        |
| Concealed .....                                    | 42         | 436    |
| Sandstone, concealed and sandstone.....            | 50         | 486    |
| Concealed .....                                    | 11         | 497    |
| Concealed along steep bluff.....                   | 28         | 525    |
| Concealed .....                                    | 40         | 565    |
| <b>Allegheny Series (132')</b>                     |            |        |
| Concealed to top of coal shaft.....                | 5          | 570    |
| <b>Shaft Record (elevation top, 1050' L-A. T.)</b> |            |        |
| Unrecorded .....                                   | 45         | 615    |
| Coal, Lower Freeport.....                          | 2          | 617    |
| Unrecorded to bottom of shaft.....                 | 58         | 675    |
| Unrecorded in test boring.....                     | 15         | 690    |
| Coal, Upper Kittanning.....                        | 7          | 697    |
|  |            | 132'   |

According to Mr. Bailey, the coal at 45 feet in the shaft was prospected for about 300 yards, and varied from 1½ to 4 feet in thickness. Work had ceased on the shaft at that time (July 22, 1911). The coal at the bottom of the section was reported in a test boring at a depth of 120 feet at the shaft.

The following section was obtained on Flat run along the southwest border of Knottsville district by combining a hand-leveled section measured from the summit of the high knob located 0.7 mile northeast of Stonehouse, down the steep hill southeastward, with the logs of the E. E. McDaniel Coal Test Boring (725) and the Lucinda McDaniel No. 1 Well (726) on the same stream. Owing to the rapid dip of the strata to the northwest, the intervals and thicknesses of formations are con-

siderably less than they should be in that portion of the section above the top of the bore hole (725). E. H. Bennett at Stonehouse is authority for the well records:

### Section at Stonehouse, Knottsville District.

| <i>Upper Carboniferous (1083')</i><br><b>Conemaugh Series (432')</b>                                 | Thickness. |     | Total. |     |      |  |
|--|------------|-----|--------|-----|------|--|
|  | Ft.        | In. | Ft.    | In. |      |  |
| Concealed and sandstone, Connells-ville, capping knob 0.7 mile north-east of Stonehouse.....         | 39         | 0   | 39     | 0   | 39'  |  |
| Concealed and limy shale.....  | 50         | 0   | 89     | 0   |      |  |
| Concealed .....  | 83         | 0   | 172    | 0   |      |  |
| Sandstone, coarse, brown and pebbly, Grafton .....   | 16         | 0   | 188    | 0   | 167' |  |
| Concealed .....  | 13         | 0   | 201    | 0   |      |  |
| Shale, dark brown, marine fossils, Ames .....  | 5          | 0   | 206    | 0   |      |  |
| Concealed .....  | 20         | 0   | 226    | 0   | 164' |  |
| Limestone, Ewing .....   | 5          | 0   | 231    | 0   |      |  |
| Concealed .....  | 26         | 0   | 257    | 0   |      |  |
| Concealed with shale along steep bluff .....   | 40         | 0   | 297    | 0   | 164' |  |
| Concealed .....  | 33         | 0   | 330    | 0   |      |  |
| Sandstone, shaly, Buffalo.....   | 22         | 0   | 352    | 0   |      |  |
| Concealed .....  | 17         | 0   | 369    | 0   | 164' |  |
| Coal, Brush Creek.....   | 1          | 0   | 370    | 0   |      |  |
| Shale and concealed to top E. E. McDaniel boring (725).....  | 34         | 0   | 404    | 0   |      |  |
| <b>E. E. McDaniel Diamond Drill Boring Record (725).</b><br>(Elevation of well mouth, 1105' B-A. T.) |            |     |        |     |      |  |
| Surface clay .....   | 22         | 0   | 426    | 0   | 62'  |  |
| Sandstone, coarse .....  | 1          | 0   | 427    | 0   |      |  |
| Shale, Uffington .....   | 5          | 0   | 432    | 0   |      |  |
| <b>Allegheny Series (276')</b>   |            |     |        |     |      |  |
| Coal, Upper Freeport (elevation of base, 1075' B-A. T.).....   | 1          | 2   | 433    | 2   | 66'  |  |
| Black slate and shale, mixed.....  | 4          | 0½  | 437    | 2½  |      |  |
| Bone, streaked with coal.....  | 11         | 2   | 448    | 4½  |      |  |
| Shale, soft .....  | 7          | 6   | 455    | 10½ |      |  |
| Shale, mixed with silicious limestone boulders intermingled, Upper Freeport Limestone .....          | 20         | 6   | 476    | 4½  |      |  |
| Shale, soft .....  | 8          | 2   | 484    | 6½  |      |  |
| Shale, mixed and gritty.....   | 7          | 10  | 492    | 4½  |      |  |
| Sandstone, light gray.....   | 2          | 4   | 494    | 8½  |      |  |
| Black slate and sandstone mixed.....   | 0          | 4   | 495    | 0½  |      |  |
| Black slate .....  | 0          | 5½  | 495    | 6   |      |  |
| Coal, Lower Freeport.....  | 2          | 6   | 498    | 0   |      |  |
| Shale, dark .....  | 5          | 4   | 503    | 4   |      |  |
| Sandstone, fine, to horizon of top well (726) .....  | 4          | 8   | 508    | 0   |      |  |
| <b>Lucinda McDaniel No. 1 Well Record (726)</b><br>(Elevation of well mouth, 998' L-A. T.)           |            |     |        |     |      |  |
| Sandstone, fine, with bastard lime heavily intermingled .....  | 6          | 7   | 514    | 7   |      |  |

|   | Thickness.<br>Feet. In.             | Total.<br>Feet. In. |       |
|---|-------------------------------------|---------------------|-------|
| Sand, fine, blue and mixed ....6' 10"                 | } Lower<br>Freeport<br>Sandstone .. | 34 0                | 548 7 |
| Sand, light blue.7 11                                 |                                     |                     |       |
| Shale, mixed, hard .....8 0                           |                                     |                     |       |
| Sand, fine blue, whetstone .....2 9                   |                                     |                     |       |
| Shale, mixed and gritty .....7 11                     |                                     |                     |       |
| Sand, hard and white to bot- tom .....0 7             |                                     |                     |       |
| Unrecorded .....                                      | 49 5                                | 598 0               |       |
| Coal (Lower Kittanning).....                          | 4 0                                 | 602 0               |       |
| Unrecorded .....                                      | 106 0                               | 708 0               |       |
| <b>Pottsville Series (375')</b>                       |                                     |                     |       |
| Sand (Homewood) .....                                 | 40 0                                | 748 0               |       |
| Unrecorded .....                                      | 10 0                                | 758 0               |       |
| Sand (Upper Connoquenessing).....                     | 60 0                                | 818 0               | 110'  |
| Slate .....   | 97 0                                | 915 0               |       |
| Coal, Quakertown? .....                               | 4 0                                 | 919 0               | 101'  |
| Slate .....   | 79 0                                | 998 0               |       |
| Sand (Sharon) .....                                   | 85 0                                | 1083 0              | 164'  |
| <i>Lower Carboniferous (765')</i>                     |                                     |                     |       |
| <b>Mauch Chunk Series (251')</b>                      |                                     |                     |       |
| Red rock .....  | 55 0                                | 1138 0              |       |
| Unrecorded and lime .....                             | 175 0                               | 1313 0              |       |
| Unrecorded .....                                      | 21 0                                | 1334 0              | 251'  |
| <b>Greenbrier Limestone (134')</b>                    |                                     |                     |       |
| Big Lime (big water at 880').....                     | 134 0                               | 1468 0              | 134'  |
| <b>Pocono Sandstones (380').</b>                      |                                     |                     |       |
| Sand, Big Injun.....                                  | 130 0                               | 1598 0              |       |
| Unrecorded .....                                      | 200 0                               | 1798 0              |       |
| Sand, Fifty-foot? (Berea).....                        | 50 0                                | 1848 0              | 380'  |
| <i>Devonian (1152')</i>                               |                                     |                     |       |
| <b>Catakill Series (850')</b>                         |                                     |                     |       |
| Slate (water, bottom).....                            | 20 0                                | 1868 0              |       |
| Sand, Thirty-foot? (Gantz and Fifty-foot) .....       | 170 0                               | 2038 0              |       |
| Sand (Thirty-foot) .....                              | 50 0                                | 2088 0              |       |
| Lime .....  | 20 0                                | 2108 0              |       |
| Red Rock .....  | 163 0                               | 2271 0              |       |
| Sand, Gordon .....                                    | 12 0                                | 2283 0              |       |
| Slate, shells and unrecorded.....                     | 165 0                               | 2448 0              |       |
| Sand, Bayard .....                                    | 50 0                                | 2498 0              |       |
| Slate and shells.....                                 | 200 0                               | 2698 0              | 850'  |
| <b>Chemung (302')</b>                                 |                                     |                     |       |
| Slate and shells and concealed.....                   | 302 0                               | 3000 0              | 302'  |
| (10" casing, 157'; 8" casing, 600'; 6" casing, 1100') |                                     |                     |       |

The following is a record of a coal test boring (724) drilled in 1904 by the Mohawk Smokeless Coal Company. This boring as well as No. 725 was put down with a churn drill,

but a core was taken out of the coals. The well starts 115 feet by aneroid below the Brush Creek coal exposed in the hill directly northeast of the boring; hence, according to the section above, the base of the Conemaugh series comes 35 to 40 feet above the well mouth:

### E. H. Bennett No. 2 Coal Test Boring Record (724).

Located in Knottsville District, 0.2 mile north of Stonehouse.

| <i>Upper Carboniferous (139.7')</i><br><b>Allegheny Series (139.7')</b> | Thickness. |     | Total. |     |       |
|---|------------|-----|--------|-----|-------|
|   | Ft.        | In. | Ft.    | In. |       |
| Surface (elevation, 1022' L-A. T.)....                                  | 1          | 0   | 1      | 0   |       |
| Clay .....  | 5          | 0   | 6      | 0   |       |
| Sandstone .....   | 2          | 3   | 8      | 3   |       |
| Shale .....   | 18         | 3½  | 26     | 6½  |       |
| Slate .....   | 0          | 1½  | 26     | 8   |       |
| Coal, Lower Freeport.....   | 1          | 6   | 28     | 2   | 28.2' |
| Fire clay .....   | 1          | 0   | 29     | 2   |       |
| Shale, mixed with sandstone (Lower Freeport) .....                      | 37         | 0½  | 66     | 2½  |       |
| Sandstone (Lower Freeport).....   | 11         | 4½  | 77     | 7   |       |
| Sandstone and shale mixed.....  | 7          | 2   | 84     | 9   |       |
| Slate .....   | 0          | 3   | 85     | 0   |       |
| Coal, Upper Kittanning "rider".....                                     | 1          | 6   | 86     | 6   |       |
| Shale and fire clay.....  | 2          | 0½  | 88     | 6½  |       |
| Black slate with shale at bottom....                                    | 1          | 5½  | 90     | 0   |       |
| Coal, slaty, "roof" ....0' 4"   |            |     |        |     |       |
| Parting ....0 1½  |            |     |        |     |       |
| Coal, sulphurous.....1 2¼   |            |     |        |     |       |
| Parting, with ¼" of coal between...0 2¼                                 |            |     |        |     |       |
| Coal .....0 2   |            |     |        |     |       |
| Hard fire clay or shale.....  | 0          | 3½  | 92     | 4   |       |
| Shale .....   | 27         | 3¼  | 119    | 7¼  |       |
| Slate .....   | 0          | 10½ | 120    | 5¼  |       |
| Coal .....0' 1"   |            |     |        |     |       |
| Coal and slate parting ...0 1¼  |            |     |        |     |       |
| Coal .....0 10  |            |     |        |     |       |
| (Upper Kittanning coal) .....   | 2          | 0½  | 92     | 0½  | 63.9' |
| (Middle Kittanning coal) .....  | 1          | 0¼  | 121    | 6   | 29.4' |
| Fire clay.....  | 0          | 3   | 121    | 9   |       |
| Shale .....   | 4          | 3½  | 126    | 0½  |       |
| Sandstone .....   | 0          | 3½  | 126    | 4   |       |
| Slate .....   | 7          | 2   | 133    | 6   |       |

|  | Thickness.<br>Feet. In. | Total.<br>Feet. In. |                                     |
|--|-------------------------|---------------------|-------------------------------------|
| Coal .....                                 | 0' 1"                   |                     | } Lower<br>Kittanning<br>coal ..... |
| Slate .....                                | 0 6%                    |                     |                                     |
| Coal .....                                 | 0 0%                    |                     |                                     |
| Slate .....                                | 0 2½                    |                     |                                     |
| Coal with 4"<br>of bone in-<br>termingled. | 1 9½                    |                     |                                     |
| Parting .....                              | 0 3                     |                     |                                     |
| Coal .....                                 | 3 0¼                    |                     |                                     |
| Fire clay to bottom of hole.....           | 0 3                     | 139 8¾              | 0.2'                                |

The above boring record is interesting in that all three of the Kittanning group of coals appear to be represented.

The following hand-leveled section was measured in the southern edge of Knottsville district from the summit of the high knob located 0.5 mile northwest of Cecil, southwestward to the bed of the river 200 yards below Cecil railroad station. The basal 66 feet of the section was supplied from exposures on the south, or opposite side of the river. The Allegheny series has thinned away 40 to 60 feet from its usual thickness in the northern portion of the State:

**Section at Cecil, Knottsville District.**

| <i>Upper Carboniferous (726')</i>   | Thickness. | Total. |      |
|---|------------|--------|------|
| <b>Conemaugh Series (506')</b>  | Feet.      | Feet.  |      |
| Concealed and variegated shale from top knob ½ mile northwest of Cecil..... | 34         | 34     |      |
| Sandstone massive coarse brown, Con-<br>nellsville .....                    | 30         | 64     | 64'  |
| Concealed and red variegated shale,<br>Clarksburg .....                     | 38         | 102    |      |
| Sandstone, massive.....   | 5          | 107    |      |
| Reds, dark, purplish.....   | 15         | 122    |      |
| Reds .....  | 20         | 142    |      |
| Concealed, mostly sandstone, Morgantown..                                   | 52         | 194    |      |
| Sandstone, massive, coarse, brown and<br>pebbly, Grafton.....               | 35         | 229    |      |
| Concealed .....   | 6          | 235    |      |
| Shale, dark green, marine fossils, Ames....                                 | 1          | 236    | 172' |
| Concealed .....   | 20         | 256    |      |
| Concealed, mostly reds, Pittsburgh.....                                     | 27         | 283    |      |
| Sandstone, shaly, Saltsburg, forms steep<br>bluff .....                     | 25         | 308    |      |
| Concealed .....   | 10         | 318    |      |
| Shale, sandy and dark gray.....   | 6          | 324    |      |
| Coal, Bakerstown, (old opening).....  | 3          | 327    | 91'  |
| Concealed .....   | 32         | 359    |      |
| Concealed along bench.....  | 17         | 376    |      |

|  | Thickness. | Total. |      |
|--|------------|--------|------|
|  | Feet.      | Feet.  |      |
| Sandstone and sandy shale, forming steep bluff .....                       | 30         | 406    |      |
| Concealed .....  | 5          | 411    |      |
| Concealed along bench.....   | 18         | 429    |      |
| Sandstone, massive, with large quartz pebbles near base, Mahoning.....     | 14         | 443    |      |
| Concealed along bench.....   | 20         | 463    |      |
| Concealed, steep slope.....  | 3          | 466    |      |
| Fire clay shale.....   | 20         | 486    |      |
| Concealed along bench.....   | 20         | 506    | 179' |
| <b>Allegheny Series (180')</b>   |            |        |      |
| Concealed along bench.....   | 10         | 516    |      |
| Shale .....  | 6          | 522    |      |
| Sandstone, buff, massive, Upper Freeport..                                 | 13         | 535    |      |
| Concealed, mostly sandstone.....   | 32         | 567    |      |
| Coal, Lower Freeport.....  | 1          | 568    | 62'  |
| Concealed and shale.....   | 10         | 578    |      |
| Sandstone, massive, Lower Freeport.....                                    | 42         | 620    |      |
| Coal .....   | 1' 6"      |        |      |
| Fire clay and shaly sandstone.....   | 4 0        |        |      |
| Cannel slate.....  | 0 6        |        |      |
| Coal, concealed, estimated .....   | 4 0        |        |      |
| Fire clay and concealed.....   | 5.5        | 635.5  |      |
| Limestone, gray and hard, Johnstown Cement bed .....                       | 2.5        | 638    |      |
| Shale and concealed to railroad grade 200 yards west of Cecil Station..... | 8          | 646    |      |
| Concealed to top Lower Kittanning coal in river bed.....                   | 14         | 660    |      |
| Coal, bony...0' 10"  |            |        |      |
| Coal, good....1 8  |            |        |      |
| Coal, bony....1 0  |            |        |      |
| Coal, good....2 4  |            |        |      |
| Shale, gray...0 2  |            |        |      |
| Coal, good....0 4  |            |        |      |
| Fire clay and concealed.....   | 20         | 686    | 20'  |
| <b>Pottsville Series (40')</b>   |            |        |      |
| Sandstone, massive, pebbly, white, Homewood .....                          | 40         | 726    | 40'  |

The section is very important, in that accurate measurements are given from the well known **fossiliferous Ames shale** to established formations of the Conemaugh and Allegheny series. The presence of the Johnstown Cement limestone therein fixes the correlation of the Upper Kittanning coal, the latter coming about 115 feet below the top of the Allegheny series.

**SUMMARY.**

The following table gives not only the thickness in many instances of the Upper Carboniferous, Lower Carboniferous, and Devonian as shown by the foregoing general sections, but it also exhibits in many cases the thickness of the several series under each. The sections have been arranged in alphabetical order for the places at which they were measured. Under the columns showing thicknesses and totals the short row of dots indicates that the series was not represented in the section, while the dash line in parenthesis indicates that the formations were present but not separated from the contiguous series:



Table Showing Thickness in Feet of the Stratified Rocks in the Monongalia-Marion-Taylor Area.

| PLACE MEASURED               | UPPER CARBONIFEROUS |                  |                |                |                |       | LOWER CARBONIFEROUS |                         |                         | DEVONIAN |              | Total Section |              |       |
|------------------------------|---------------------|------------------|----------------|----------------|----------------|-------|---------------------|-------------------------|-------------------------|----------|--------------|---------------|--------------|-------|
|                              | Dun-<br>Lard        | Monon-<br>Gabela | Cose-<br>maugh | Alle-<br>gheny | Pots-<br>ville | Total | March<br>Chuk       | Greenbrier<br>Limestone | Pocahontas<br>Sandstone | Total    | Cal-<br>kill |               | Che-<br>mung | Total |
|                              |                     |                  |                |                |                |       |                     |                         |                         |          |              |               |              |       |
| Aaron Creek.....             |                     |                  | 285            | 124            |                | 409   |                     |                         |                         |          | 839          |               | 409          |       |
| Anita.....                   |                     |                  | 306            | 183            |                | 489   |                     |                         |                         |          |              |               | 489          |       |
| Barrackville.....            | 234                 | 180              |                |                |                | 434   |                     |                         |                         |          |              |               | 434          |       |
| Beaverhoop.....              |                     |                  | 271            |                | 314            | 1189  | 226                 | 92                      | 296                     | 676      |              |               | 1189         |       |
| Behler.....                  |                     | 67               | 350            |                |                | 417   |                     |                         |                         |          |              |               | 417          |       |
| Cassville.....               | 528                 | 350.6            |                |                |                | 878.6 |                     |                         |                         |          |              |               | 878.6        |       |
| Cecil.....                   | 567                 | 384              | 585            | 252            | 271            | 2059  | 117                 | 60                      | 461                     | 638      | 47           | 886           | 3583.6       |       |
| Cheatview.....               |                     |                  | 536            | 180            | 40             | 726   |                     |                         |                         |          |              |               | 726          |       |
| Clinton Furnace.....         |                     |                  | 150            | 195            |                | 345   | 299                 | 110                     | 520                     | 829      | 85           |               | 1049         |       |
| Crossroads.....              | 988                 | 575              |                |                |                | 1563  |                     |                         |                         |          |              |               | 345          |       |
| Dakota.....                  | 214.5               | 195.5            |                |                |                | 410   |                     |                         |                         |          |              |               | 1863         |       |
| Downs.....                   | 410                 | 407              | 593            | 202            | 231            | 1873  | 177                 | 105                     | 104                     | 386      |              |               | 2259         |       |
| Easton.....                  |                     | 100              | 545.8          |                |                | 645.8 |                     |                         |                         |          |              |               | 645.8        |       |
| Fairview.....                | 692                 | 397              |                |                |                | 1089  |                     |                         |                         |          |              |               | 1089         |       |
| Farmington (Underwood).....  | 319                 | 393.4            |                |                |                | 712.4 |                     |                         |                         |          |              |               | 712.4        |       |
| Glover Gap.....              | 940                 | 258              | 536            | 212            | 334            | 2280  | 123                 | 87                      | 500                     | 710      | 251          |               | 3341         |       |
| Grafton.....                 |                     |                  | 334            | 70             |                | 404   |                     |                         |                         |          |              |               | 404          |       |
| Hammond.....                 |                     |                  | (305)          |                |                | 500   |                     |                         |                         |          |              |               | 500          |       |
| Ices Run-Fairmont.....       | 207                 | 393.8            | 1.6            |                |                | 602.4 |                     |                         |                         |          |              |               | 602.4        |       |
| Irontdale.....               |                     |                  | 390            | 270            | 10             | 670   |                     |                         |                         |          |              |               | 670          |       |
| Little Falls.....            |                     |                  | 532.5          | 38.5           |                | 571   |                     |                         |                         |          |              |               | 571          |       |
| McClaren (W. of Easton)..... |                     |                  | 318.6          | 77.4           |                | 396   |                     |                         |                         |          |              |               | 396          |       |
| Mannington.....              | 507                 | 395              |                |                |                | 902   |                     |                         |                         |          |              |               | 902          |       |
| Meadland.....                |                     | 100              | 395            |                |                | 495   |                     |                         |                         |          |              |               | 495          |       |
| Monongah-NW.....             | 191.5               | 381.2            | 1.2            |                |                | 573.9 |                     |                         |                         |          |              |               | 573.9        |       |
| Monongah-SE.....             | 25                  | 431              |                |                |                | 456   |                     |                         |                         |          |              |               | 456          |       |
| Mooreville.....              | 675                 | 382.2            | 0.8            |                |                | 1058  |                     |                         |                         |          |              |               | 1058         |       |
| Montana Mines.....           | 243                 | 607              | 230            | 200            | 1340           | 250   | 68                  | 365                     | 683                     | 800      | 684          | 1484          | 3507         |       |
| Morgan Run.....              | 130                 | 602              | 239            | 252            | 1253           | 177   | 85                  | 520                     | 782                     | 845      | 104          | 949           | 2984         |       |
| Morgantown.....              |                     | 95               | 605.5          | 238.5          | 205            | 1144  |                     |                         |                         |          |              |               | 1144         |       |
| Mt. Chateau Hotel.....       |                     |                  | 135            | 240            | 2.5            | 580   |                     |                         |                         |          |              |               | 580          |       |
| Powell.....                  |                     |                  | 177            | 226            | 149            | 602   |                     |                         |                         |          |              |               | 602          |       |
| Quarry Run.....              |                     | 297              | 166            |                | 187.8          | 483   | 300                 | 85                      | (...)                   | (...)    | (...)        | (...)         | 1272.3       |       |
| Randall (Jintown).....       | 405                 | 170              |                |                |                | 575   |                     |                         |                         |          |              |               | 463          |       |
| Rivesville.....              |                     |                  | 296            | 150.3          |                | 446.3 |                     |                         |                         |          |              |               | 446.3        |       |
| Rock Forge.....              |                     |                  |                |                | 320            | 320   |                     |                         |                         |          |              |               | 320          |       |
| Rohr.....                    |                     |                  | 599            | 148.2          |                | 747.2 |                     |                         |                         |          |              |               | 747.2        |       |
| Sabraton.....                | 45                  | 559              |                |                |                | 604   | 188                 | 74                      | 577                     | 779      | 651          |               | 3834         |       |
| St. Cloud.....               | 1068                | 350              | 550            | 259            | 270            | 2504  | 251                 | 134                     | 380                     | 765      | 850          | 302           | 1162         | 3000  |
| Stonchouse.....              |                     |                  | 432            | 276            |                | 1088  |                     |                         |                         |          |              |               | 1088         |       |
| Sturgis.....                 |                     |                  |                |                |                | (...) |                     |                         |                         |          |              |               | (...)        |       |
| Thornton.....                |                     |                  | 540            | 59             |                | 599   |                     |                         |                         |          |              |               | 599          |       |
| Thornton-SW.....             |                     |                  | 565            | 132            |                | 697   |                     |                         |                         |          |              |               | 697          |       |
| Triune.....                  |                     |                  | 158            | 213            |                | 371   |                     |                         |                         |          |              |               | 371          |       |
| Tyrcennell Mines.....        |                     | 274              |                |                |                | 615   |                     |                         |                         |          |              |               | 615          |       |
| Van Voorhis.....             |                     |                  | 539.3          | 94.4           |                | 633.7 |                     |                         |                         |          |              |               | 633.7        |       |
| Webster.....                 | 52                  | 559              | 181.2          |                | 150.8          | 973   |                     |                         |                         |          |              |               | 973          |       |
| Whetstone Run.....           | 650                 | 395              | 539            | (...)          | (...)          | (...) |                     |                         |                         |          |              |               | 3244         |       |
| Worthington.....             | 204                 | 322              |                |                |                | 526   |                     |                         |                         |          | 356          |               | 356          |       |

The foregoing sections from Monongalia-Marion-Taylor area give a maximum thickness of the outcropping rocks in this portion of the State of 3825 feet, divided as follows:

**Upper Carboniferous:**

|                         | Feet.              |
|-------------------------|--------------------|
| Dunkard Series.....     | 1066               |
| Monongahela Series..... | 431                |
| Conemaugh Series.....   | 607                |
| Allegheny Series.....   | 276                |
| Pottsville Series.....  | 375.....2755 feet. |

**Lower Carboniferous:**

|                           |                    |
|---------------------------|--------------------|
| Mauch Chunk Series.....   | 335                |
| Greenbrier Limestone..... | 160                |
| Pocono Sandstones.....    | 575.....1070 feet. |
| <b>Total.....</b>         | <b>3825 feet.</b>  |

# CHAPTER V.

## STRATIGRAPHY—DUNKARD SERIES.

The Dunkard series is the highest division of the Carboniferous system of rocks in the Appalachian area of North America, and, except the alluvium along the stream bottoms and old terrace deposits, it is the most recent formation in the Monongalia-Marion-Taylor area. The series was so named from Dunkard creek, a stream flowing eastward into the Monongahela river in the southwestern corner of the State of Pennsylvania, by I. C. White, whose original description is as follows<sup>1</sup>:

"The uppermost beds are found at the headwaters of Dunkard creek, a large stream which heads near the West Virginia-Pennsylvania line, on the eastern slope of the water-shed separating the Ohio and Monongahela river drainage systems, and flowing eastward, puts into the Monongahela two miles above Greensboro, Greene county, Pennsylvania, and four miles north from the West Virginia line. This stream flows over the Permo-Carboniferous rocks from its source to the point at which it leaves the West Virginia line at Mount Morris, Pennsylvania, a distance of more than thirty miles, furnishing very fine exposures of these rocks along its banks and bluffs; hence, the geographical name, Dunkard, which I have given the series."

This group of rocks was first called the **Upper Barren measures** on the supposition that it contained no coal beds of economic value, and for a long time was placed under the compromise term, **Permo-Carboniferous**, on account of the presence of fossil plants of the Permian age in its shales and slates, and the failure to find a Permian fauna.

The base of the series was placed by I. C. White where Permian plants were first observed in the fossil flora, viz.: the Cassville shale immediately over the Waynesburg coal.

In West Virginia and in the area under discussion, this group of rocks consists largely of a succession of brown and grayish green sandstones, interstratified with red shales, a few

<sup>1</sup> Bulletin 65, U. S. G. Survey, I. C. White; page 20: 1891.

thin limestones, and several thin and unimportant coal beds with the possible exception of the Washington coal. The soils formed from the disintegration of these rocks bears a great reputation for producing a fine grade of wool, and for this reason that portion of the State where these measures come to the surface, is often referred to as the "sheep belt," since by far the greater percentage of the fine wool sheep raised in West Virginia are grown on the outcrop of the Dunkard rocks.

The following general section of the Dunkard series includes all known and described formations to the date of this report, and is a slight modification of the same published on pages 134 and 135 of the Doddridge-Harrison report by the writer:

#### General Section, Dunkard Series, for West Virginia:

|  | Thickness.<br>Feet. | Total.<br>Feet. |      |
|--|---------------------|-----------------|------|
| Sandstone, flaggy, (Upper Proctor).....  | 40                  | 40              |      |
| Shale .....  | 15                  | 55              |      |
| Sandstone, (Middle Proctor).....   | 25                  | 80              |      |
| Shale .....  | 10                  | 90              |      |
| Sandstone, massive, green, micaceous<br>(Lower Proctor).....                           | 25                  | 115             |      |
| Shale, red and variegated.....   | 35                  | 150             |      |
| Limestone, Windy Gap.....  | 5                   | 155             |      |
| Sandstone, massive, (St. Cloud).....   | 20                  | 175             |      |
| Shale, sandy.....  | 4                   | 179             |      |
| Coal, slaty, Windy Gap, 3" to.....   | 1                   | 180             | 180' |
| Fire clay, shale, red, and variegated, with<br>layers of limestones and sandstones.... | 80                  | 260             |      |
| Sandstone, massive, Gilmore.....   | 30                  | 290             | 110' |
| Coal, (Gilmore).....   | 1                   | 291'            |      |
| Limestone, (Gilmore).....  | 1                   | 292             |      |
| Shale, variegated and red, with thin sand-<br>stones .....                             | 93                  | 385             |      |
| Limestone, Upper (Rockport).....   | 5                   | 390             |      |
| Sandstone, (Taylor).....   | 30                  | 420             |      |
| Limestone, Middle (Rockport).....  | 5                   | 425             |      |
| Sandstone, and shale, buff and red.....  | 29                  | 454             |      |
| Coal, (Nineveh "A") 3" to.....   | 1                   | 455             | 65'  |
| Limestone, (Lower Rockport).....   | 5                   | 460             |      |
| Shale, brown and variegated.....   | 15                  | 475             |      |
| Sandstone, massive, coarse and brown,<br>Nineveh .....                                 | 25                  | 500             |      |
| Shale, 1' to.....  | 4                   | 504             |      |
| Coal, Nineveh.....   | 1                   | 505             | 50'  |
| Fire clay and limy shale.....  | 10                  | 515             |      |
| Limestone, Nineveh.....  | 5                   | 520             |      |
| Shale, variegated and red.....   | 30                  | 550             |      |

|   | Thickness. | Total. |      |
|---|------------|--------|------|
|   | Feet.      | Feet.  |      |
| Sandstone, massive, (Burton).....               | 29         | 579    |      |
| Coal, Hostetter.....                            | 1          | 580    | 75'  |
| Shale, sandy, with thin sandstones.....         | 60         | 640    |      |
| Sandstone, massive, (Fish Creek).....           | 34         | 674    |      |
| Coal, (Fish Creek).....                         | 1          | 675    | 95'  |
| Fire clay shale, (Fish Creek).....              | 5          | 680    |      |
| Shale, sandy and red, with thin sandstones      | 29         | 709    |      |
| Sandstone, massive, (Rush Run).....             | 25         | 734    |      |
| Shale, sandy.....                               | 5          | 739    |      |
| Coal, Dunkard.....                              | 1          | 740    | 65'  |
| Fire clay and shale, red, sandy and variegated. | 29         | 769    |      |
| Sandstone, (Jollytown).....                     | 20         | 789    |      |
| Coal, Jollytown.....                            | 1          | 790    | 50'  |
| Fire clay.....                                  | 1          | 791    |      |
| Limestone, Upper Washington.....                | 4          | 795    |      |
| Shale, limy.....                                | 5          | 800    |      |
| Sandstone, (Hundred).....                       | 34         | 834    |      |
| Coal, (Hundred) (5") to.....                    | 1          | 835    | 44'  |
| Fire clay and red and variegated shale.....     | 34         | 869    |      |
| Sandstone, (Upper Marietta).....                | 50         | 919    |      |
| Coal, Washington "A".....                       | 1          | 920    | 85'  |
| Shale, red, (Creston).....                      | 60         | 980    |      |
| Limestone, Middle Washington.....               | 5          | 985    |      |
| Sandstone, (Lower Marietta).....                | 40         | 1025   |      |
| Limestone, Lower Washington.....                | 2          | 1027   |      |
| Coal, Washington.....                           | 3          | 1030   | 110' |
| Fire clay shale, (Washington).....              | 10         | 1040   |      |
| Limestone, (Bristol).....                       | 2          | 1042   |      |
| Sandstone, Washington.....                      | 10         | 1052   |      |
| Coal, Little Washington.....                    | 1          | 1053   |      |
| Shale.....                                      | 7          | 1060   |      |
| Sandstone, (Mannington) (Waynesburg "B"         |            |        |      |
| coal horizon near middle).....                  | 45         | 1105   |      |
| Shale.....                                      | 4          | 1109   |      |
| Coal, Waynesburg "A".....                       | 1          | 1110   | 80'  |
| Fire clay and shale.....                        | 3          | 1113   |      |
| Limestone, Mt. Morris.....                      | 2          | 1115   |      |
| Shale.....                                      | 12         | 1127   |      |
| Sandstone, coarse, brown and pebbly,            |            |        |      |
| Waynesburg.....                                 | 45         | 1172   |      |
| Limestone, dark flaggy, (Elm Grove).....        | 3          | 1175   |      |
| Shale, dark, sandy with fossil plants, Cass-    |            |        |      |
| ville.....                                      | 5          | 1180   | 70'  |
| Coal, Waynesburg.....                           |            |        |      |

The names in parentheses—25 in number—have all been added by the writer and others since the publication of the original Dunkard Creek section by I. C. White on page 22 of Bulletin 65 of the U. S. G. Survey in 1891.

The crop of the Dunkard series in the area under discussion is confined entirely to those portions of Monongalia and Marion counties lying west of the Monongahela and





PLATE XI.--Topography of the Dunkard Series, at summit between Indian Creek and Pharoah Run,  $\frac{1}{2}$  mile south-west of Arnettville, Monongalia County.

Photo by Ray Bricker.

Tygart Valley rivers, and just catches the summits of the highest hills in the Ligonier Basin southwest of Flemington in Taylor county. The extent of this rock group is graphically exhibited on Map II. The maximum thickness of these measures left uneroded—1090 to 1100 feet—occurs at Honsocket Knob near St. Cloud, in the northwest corner of Monongalia county, and at the high knob at the common corner to Marion, Harrison and Wetzel counties. The summit of the former knob reaches an elevation of 1646' L-A. T., while the base of the Pittsburgh coal or base of the Monongahela series is only 206' L-A. T. in the Barney Renner No. 2238 well (36) located on the southeast side of the Knob. The thickness of the Monongahela series as shown by the St. Cloud section, page 92, is only 350 feet; hence, 1090 feet are left for the Dunkard rocks—90 feet less than that published for the Steels Run, Wetzel county, Section<sup>2</sup>, the latter being the maximum yet reported for the Appalachian area. Allowing 390 feet for the thickness of the Monongahela series at the second knob, there remains above about 1100 feet of Dunkard rocks.

### MONONGALIA COUNTY SECTIONS, DUNKARD SERIES.

In the preceding chapter of this report, the rock succession of the Dunkard series in Monongalia county is exhibited in several of the general sections, and special reference is here made to the St. Cloud and Behler sections. In addition, two sections—one in Battelle and the other in Clay district—of this group of rocks will now be given.

The following hand-leveled section was measured along the northern border of Battelle district from the summit of the high knob, located 0.5 mile southeast of Maple, southward along the hill road to the Thos. White No. 1 gas well (10) on Brushy fork. The section is very important in that it exhibits the true relative positions of the Lower Rockport limestone, and the Nineveh, Hostetter, Fish Creek, Dunkard and Jollytown coals.

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2. Marshall-Wetzel-Tyler Report, page 106; 1909.



The Nineveh-Hostetter coal interval is 12 feet greater than that given by the writer in the Burton, Wetzel county, Section on page 110 of the Marshall-Wetzel-Tyler County report. The Jollytown-Nineveh coal interval is shown to be 252 feet:

### Section Near Maple, Battelle District.

|  | Thickness.<br>Feet. | Total.<br>Feet. |      |
|--|---------------------|-----------------|------|
| Concealed from top of knob.....  | 16                  | 16              |      |
| Sandstone .....  | 25                  | 41              |      |
| Shale, dark (1") and shale, gray.....  | 5                   | 46              |      |
| Shale, red.....  | 16                  | 62              |      |
| Shale, sandy.....  | 32                  | 94              |      |
| Sandstone, soft, friable.....  | 15                  | 109             |      |
| Concealed to road forks (U. S. G. S. 1352' A. T., map).....                                    | 5                   | 114             |      |
| Shale, buff and sandy.....   | 26                  | 140             |      |
| Sandstone, massive, Taylor.....  | 10                  | 150             |      |
| Shale, buff.....   | 9                   | 159             |      |
| Shale, dark, and fire clay.....  | 3                   | 162             | 162' |
| Limestone, gray and hard, silicious, with shale layers, Lower Rockport.....                    | 8                   | 170             |      |
| Shale, gray and limy.....  | 4                   | 174             |      |
| Sandstone, shaly, Nineveh.....   | 13                  | 187             |      |
| Shale, sandy.....  | 10                  | 197             |      |
| Concealed .....  | 6                   | 203             |      |
| Coal, Nineveh (1262' L-A. T.).....   | 1                   | 204             | 42'  |
| Concealed .....  | 20                  | 224             |      |
| Fire clay shale.....   | 5                   | 229             |      |
| Sandstone, massive, and shale.....   | 25                  | 254             |      |
| Sandstone, massive, Burton.....  | 10                  | 264             |      |
| Shale, dark.....   | 1                   | 265             |      |
| Fire clay shale.....   | 4                   | 269             |      |
| Sandstone .....  | 5                   | 274             |      |
| Shale, red.....  | 15.7                | 289.7           |      |
| Coal, Hostetter (1176' L-A.T.).....  | 0.3                 | 290             | 86'  |
| Fire clay shale.....   | 5                   | 295             |      |
| Shale, variegated.....   | 18                  | 313             |      |
| Sandstone .....  | 4                   | 317             |      |
| Shale, variegated and red, with ferriferous limestone nuggets.....                             | 21                  | 338             |      |
| Sandstone, shaly.....  | 5                   | 343             |      |
| Shale, sandy.....  | 10                  | 353             |      |
| Concealed .....  | 5                   | 358             | 68'  |
| Fire clay shale, Fish Creek (top 1108' L-A. T.).....   | 5                   | 363             |      |
| Sandstone and concealed.....   | 47                  | 410             |      |
| Coal, Dunkard, bed of Brushy fork (1055' L-A. T.) to level of Thos. White No. 1 well (10)..... | 1                   | 411             | 53'  |
| Concealed .....  | 5                   | 416             |      |
| Shale, buff.....   | 5                   | 421             |      |
| Sandstone, massive, Jollytown.....   | 10                  | 431             |      |
| Shale, sandy.....  | 5                   | 436             |      |

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PLATE XII.—Topography of the Dunkard Series, from hill above Georgetown, Monongalia County, looking toward Little Indian Creek.

11

|  | Thickness. | Total. |      |
|--|------------|--------|------|
|  | Feet.      | Feet.  |      |
| Shale, dark.....                           | 1          | 437    |      |
| Shale, gray, concealed and shale.....      | 19         | 456    |      |
| Coal, Jollytown.....                       | 1          | 457    | 46'  |
| Unrecorded in Thos. White No. 1 well (10). | 404        | 861    | 404' |
| <b>Coal, Waynesburg.</b>                   |            |        |      |

The Dunkard coal crops in the bed of Brushy fork a short distance above the well (10), almost flush with the top of the latter. In this boring the top of the Pittsburgh coal was struck at a depth of 785 feet, which gives an accurate measurement for the Dunkard-Pittsburgh coal interval near the type locality of the former bed. That portion of the section from 411 to 457 feet was measured 0.5 mile northward from the White well (10) along the road leading from Brushy fork eastward to the head of Pumpkin run.

The following aneroid section was measured in the northwest corner of Clay district from the summit of the high knob located near the cross-roads, 2 miles northwest of Daybrook, northwestward along the hill road to the crop of the Jollytown coal. The Dunkard-Jollytown coal interval is slightly greater than it should be owing to a slight dip in the strata in the direction in which the section was measured:

**Section Two Miles Northwest of Daybrook, Clay District.**

|   | Thickness. | Total. |      |
|---|------------|--------|------|
|   | Feet.      | Feet.  |      |
| Concealed from summit of knob to cross roads.                             | 100        | 100    |      |
| Sandstone, massive, Burton.....   | 29         | 129    |      |
| Concealed and fire clay.....  | 1          | 130    |      |
| Concealed .....   | 10         | 140    |      |
| Shale .....   | 10         | 150    |      |
| Fire clay shale.....  | 10         | 160    |      |
| Sandstone, massive, Fish Creek.....                                       | 30         | 190    |      |
| Concealed .....   | 45         | 235    |      |
| Coal, blossom, Dunkard.....   | 0          | 235    | 235' |
| Concealed and fire clay.....  | 5          | 240    |      |
| Shale, brown.....   | 5          | 245    |      |
| Sandstone, massive, Jollytown.....  | 30         | 275    |      |
| Concealed .....   | 21         | 296    |      |
| Shale, gray.....  | 2          | 298    |      |
| Coal .....1' 6" } (25") Jollytown coal                                    | 2          | 300    | 65'  |
| Shale, gray....0 3½ } (elevation, 1140' B-A. T.)                          |            |        |      |
| Coal .....0 3½ }  |            |        |      |
| Fire clay and gray shale.....   | 3          | 303    |      |
| Sandstone, limy and nodular, Upper Wash-<br>ington limestone horizon..... | 4          | 307    | 7'   |

The base of the section comes about 790 feet above the Pittsburgh coal horizon, and allowing 360 feet for the thickness of the Monongahela series, there still remains 430 feet of the Dunkard series below the base of the section, giving the total for these measures in this portion of Monongalia about 740 feet.

### MARION COUNTY SECTIONS, DUNKARD SERIES.

As with Monongalia the rock succession of the Dunkard series in Marion county is exhibited in several of the general sections for that area in the preceding chapter. In addition the following aneroid section was measured in the northern portion of Mannington district from the summit of the high knob, located 1 mile northeast of Metz, southwestward along the hill road to the mouth of Johnnycake run. The base of the section comes about 725 feet above the Pittsburgh coal:

#### Section Near Metz, Mannington District.

|  | Thickness. | Total. |      |
|--|------------|--------|------|
|  | Feet.      | Feet.  |      |
| Concealed from summit of knob to road,<br>low gap..... | 125        | 125    |      |
| Shale, buff sandy, variegated.....                     | 40         | 165    |      |
| Sandstone, shaly.....                                  | 15         | 180    |      |
| Shale, red and variegated.....                         | 15         | 195    |      |
| Sandstone, green shaly.....                            | 10         | 205    |      |
| Concealed.....   | 20         | 225    |      |
| Sandstone.....   | 5          | 230    |      |
| Concealed.....   | 25         | 255    |      |
| Sandstone, shaly.....                                  | 25         | 280    |      |
| Red shale.....   | 5          | 285    |      |
| Shale, buff sandy.....                                 | 15         | 300    |      |
| Concealed.....   | 40         | 340    |      |
| Fire clay.....   | 1          | 341    |      |
| Concealed.....   | 24         | 365    |      |
| Shale, dark red.....                                   | 5          | 370    |      |
| Shale.....   | 3          | 373    |      |
| Sandstone, shaly, Rush Run.....                        | 22         | 395    | 395' |
| Concealed.....   | 20         | 415    |      |
| Sandstone, Jollytown.....                              | 25         | 440    |      |
| Shale.....   | 5          | 445    |      |
| Coal.....0' 7" } (22") Jollytown coal.                 | 2          | 447    | 52'  |
| Shale, gray....0 3 } (1080' B.A. T.)                   |            |        |      |
| Coal.....1 0 }   |            |        |      |
| Fire clay and concealed.....                           | 8          | 455    |      |
| Sandstone.....   | 10         | 465    |      |

|  | Thickness. Total. |       |     |
|--|-------------------|-------|-----|
|  | Feet.             | Feet. |     |
| Shale .....                              | 40                | 505   | 58' |
| Coal blossom, Hundred.....               | 0                 | 505   |     |
| Concealed to mouth of Johnnycake run.... | 25                | 530   | 25' |

## DESCRIPTION OF THE DUNKARD FORMATIONS.

The character and distribution of the several formations of the Dunkard series in the Monongalia-Marion-Taylor area will now be described in detail.

### The Proctor Sandstones.

The highest formations yet described in the Appalachian area for the Dunkard series are the Proctor<sup>3</sup> sandstones which at their type locality have a thickness of 150 feet and come about 1300 feet above the Pittsburgh coal. In the St. Cloud section, page 92, the writer has separated these ledges into the **Upper Proctor**, **Middle Proctor** and **Lower Proctor sandstones**.

In **Monongalia county** their crop is confined to the summits of the high knobs which attain an elevation of 1550' to 1650' A.T. along the axis of the Robinson and Waynesburg synclines. The Crossroads section reports what appears to be the Lower Rockport sandstone, coming 1310 feet above the Pittsburgh coal.

In **Marion county** the crop of these sandstones is confined as in Monongalia, to the summits of the high knobs, attaining about the same elevation along the axes of the same synclines. No quarries were observed on these ledges.

### The St. Cloud Sandstone.

At 4 to 5 feet above the Windy Gap coal at St. Cloud post-office in the northwestern border of Battelle district, Monongalia county, there occurs a massive, micaceous, medium-grained sandstone, 15 to 20 feet thick, which has been desig-

3. Hennen, Ray V., Marshall-Wetzel-Tyler Report, W. Va. Geol. Survey, page 167; 1909.

nated by the writer the **St. Cloud sandstone** from that place. It is this stratum that forms the cliff on the head of Cappel run, 0.4 mile north 20° west of St. Cloud, where it was once quarried for building purposes on the land of Isaiah Jones. This sandstone caps the summit of Efaw knob, 1.7 miles north-east of Wadestown. Its crop in both Monongalia and Marion counties is confined to practically the same areas as that outlined for the Proctor sandstones.

The **Windy Gap limestone** of I. C. White was not observed at any point in the area under discussion.

### The Windy Gap Coal.

The highest known and described bituminous formation of the Dunkard series is the **Windy Gap coal**, which has been so designated by I. C. White<sup>4</sup> from a gap of that name along the southern border of Aleppo township, Greene county, Pa., where, according to levels made by the writer, it comes 1290 feet above the Pittsburgh coal. In the area under discussion the crop of this coal is confined to practically the same territory as that outlined for the St. Cloud and Proctor sandstones.

In **Monongalia county** this coal was observed at five different points, one of which is at the south edge of the ridge road, about 100 feet east of M. L. White's store at St. Cloud, Battelle district. Here 3 inches of shaly coal is exposed at an elevation of 1495' A. T. by aneroid. Its relative position to other formations of the Dunkard series at this place is given in the St. Cloud section, page 92.

It crops in the road, 0.1 mile northeast of the common corner to Monongalia, Marion and Wetzel counties at an elevation of 1490' A. T. by level spirit. Here it is 6 inches thick and quite slaty, coming about 1300 feet above the Pittsburgh coal.

Passing to the southeast portion of Battelle district, this coal is found cropping at an elevation of 1530' A. T. on the ridge road at the head of Range run, 1.3 miles northwest of Galletin, where the following section was measured:

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4. Bulletin 65, U. S. G. Survey, p. 31; 1891.

|                             | Ft. | In. |
|-----------------------------|-----|-----|
| Shales, sandy.....          | 10  | 0   |
| Shales, limy.....           | 5   | 0   |
| Coal, slaty, Windy Gap..... | 0   | 5   |
| Shales, limy.....           | 2   | 0   |

Here the coal comes about 1300 feet above the Pittsburgh bed.

About the same thickness of slaty coal is exposed at this horizon along the ridge road at an elevation of 1625' A. T. by aneroid, 1.3 miles northeast of Galletin, coming there 1300 feet over the Pittsburgh coal.

In **Marion county** this coal was not observed at any point, although its horizon should catch the summits of the highest hills along the axes of the Robinson and Waynesburg synclines. In the area under discussion it does not attain sufficient thickness to have any economic importance, but is of special scientific interest as being the highest (geologically) known bituminous formation in the Appalachian area.

### The Gilmore Sandstone.

The next important stratum in descending order in the Dunkard series is the Gilmore sandstone, so designated by J. J. Stevenson from the township of that name in southwestern Greene county, Pa., where it is a conspicuous cliff former near the hill summits in the southwestern portion of the township, slightly over a mile northward from the Battelle district line. It is a massive bed of coarse, yellowish gray and brown sandstone, whose cliffs are generally traversed by fissures, furnishing retreats for foxes, and for that reason is often locally known as the "Fox Rocks." At its type locality this ledge comes 215 feet above the base of the Nineveh coal, and about 1200 feet above the Pittsburgh bed.

In **Monongalia and Marion counties** this stratum forms a prominent escarpment around the hillsides near the summits of the high knobs and ridges along and near the axes of the Robinson and Waynesburg synclines. The Crossroads section, page 94, shows it 35 feet thick, 207 feet above the Nineveh limestone, 476 feet above the Jollytown coal, and



1235 feet above the Pittsburgh coal. No quarries were observed on this ledge in the area under discussion, yet it has been quarried one mile northward to some extent at its type locality in Gilmore township.

### The Gilmore Coal.

At the base of the Gilmore sandstone there frequently occurs a few inches of coal that has been named the **Gilmore**<sup>5</sup> from its association with the sandstone above. It comes 215 to 230 feet above the Nineveh coal and about 1200 feet above the Pittsburgh bed.

In the area under discussion the crop of its horizon is confined to the same territory as outlined for the Gilmore sandstone. Actual coal at this horizon was observed at only one point in Monongalia and Marion. This was in the northwestern part of Battelle district, Monongalia, along the hill road on the head of Brushy fork, 0.5 mile northeast of St. Cloud, where the following section was measured:

|  | Ft. | In. |
|--|-----|-----|
| Shale .....                            | 6   | 0   |
| Coal, shaly, Gilmore.....              | 0   | 3   |
| Fire clay.....                         | 0   | 6   |
| Limestone, gray and hard, Gilmore..... | 1   | 0   |

Here the coal comes at an elevation of 1442' A. T. by spirit-level measurement, 225 feet by hand-level above the Nineveh coal in the hill road, 0.2 mile northwestward, and 1210 feet above the Pittsburgh bed as given in the S. L. S. Spragg No. 1 well (4), 0.3 mile northwestward. As with the Windy Gap coal, it has no economic value, but is fairly persistent in western Monongalia and eastern Wetzel counties, West Virginia, and in southwestern Greene county, Pa.

5. Ray V. Hennen, Marshall-Wetzel-Tyler Report, W. Va. Geol. Survey, p. 172; 1909.

## The Gilmore Limestone.

Immediately under the Gilmore coal in the vicinity of Littleton and Uniontown, Wetzel county, there occurs a dark gray, slightly silicious limestone, 6 to 12 inches thick, that appears to be a fairly persistent formation of the Dunkard series. In the Monongalia-Marion-Taylor area, the crop of its horizon is confined to practically the same territory as outlined for the Gilmore sandstone. However, it was observed at only one locality. This was along the ridge road northeastward from St. Cloud in Battelle district. The section given above under the "Gilmore Coal" was measured at its exposure along this road. It is this limestone that crops in the road about 200 feet southwest of the Oak Forest M. E. church, 0.2 mile northeast of St. Cloud, where it is quite silicious and more or less lenticular. It does not attain sufficient thickness to have any economic importance. It was so named<sup>6</sup> from its association with the overlying coal and sandstone.

The **Upper Rockport limestone** was not observed at any point in either county.

## The Taylor Sandstone.

At 120 feet below the Gilmore sandstone and 70 feet above the Nineveh coal, there occurs a very persistent sandstone on Taylor run, in the southwestern corner of Gilmore township, Greene county, Pa., that has been named from this place by the writer<sup>7</sup> the **Taylor sandstone**. Like the Gilmore sandstone above, it forms steep bluffs and prominent escarpments around the hillsides in western Monongalia and Marion counties wherever the hills attain a height of over 1100 feet above the elevation of the Pittsburgh coal as shown by the contour lines on Map II. No quarries were observed on this ledge in either county. The sections for St. Cloud, Maple and Crossroads show its thickness and relative position to the other formations of the Dunkard measures.

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6. Ray V. Hennen, Marshall-Wetzel-Tyler Report, W. Va. Geol. Survey, page 173; 1909.

7. Ibid.

The **Middle Rockport limestone** was not observed in either county.

### The Nineveh "A" Coal.

A new coal—2 to 3 inches thick—makes its appearance in the Dunkard series along the hill road on Brushy fork, 0.8 mile northeastward from St. Cloud in Battelle district. Its accurate position in the rock column at this place is exhibited in the St. Cloud section, page 92, where it is shown to come immediately over the Lower Rockport limestone, and 48 feet—hand-level measurement—above the undoubted Nineveh coal. Since this formation has never been noted or named, the writer has designated it the **Nineveh "A" coal** from its relation to the coal next below. This is the only point it was observed in either county. It is too thin to have any economic importance, but thick enough to be easily mistaken for the Nineveh bed below on account of its similar association with an underlying limestone.

### The Lower Rockport Limestone.

At about 40 feet above the Nineveh limestone in the vicinity of Rockport in southern Wood county, there occurs 8 feet of dark gray limestone which has been designated from this place the **Lower Rockport**<sup>8</sup>.

In western **Monongalia county** this stratum attains a fair development, and is often mistaken for the Nineveh limestone, 40 feet lower in the measures. The sections for St. Cloud and Maple, pages 92 and 168, respectively, exhibit its thickness, character and relative position to other formations of the Dunkard series, especially to the Nineveh coal. Along the southwestern border of Battelle district, it is this limestone that crops along the hill road on the head of North fork, 0.8 mile westward from the mouth of Whisler run, at an elevation of 1235' A. T. by aneroid. Here the ledge is 5 feet thick, coming 40 feet above the Nineveh coal, and 1050 feet above the Pittsburgh bed. A sample for analysis was collected from

8. Ray V. Hennen, Wirt-Roane-Calhoun Rept., W. Va. Geol. Survey, p. 143; 1911.

the limestone at this place, the composition of which is reported by Messrs. Hite and Krak as follows, under Laboratory No. 599H:

|   | Per cent. |
|---|-----------|
| Silica (Si O <sub>2</sub> ).....                      | 26.17     |
| Ferric Iron (Fe <sub>2</sub> O <sub>3</sub> ).....    | 2.82      |
| Alumina (Al <sub>2</sub> O <sub>3</sub> ).....        | 6.22      |
| Calcium Carbonate (CaCO <sub>3</sub> ).....           | 57.60     |
| Magnesium Carbonate (MgCO <sub>3</sub> ).....         | 2.58      |
| Phosphoric Acid (P <sub>2</sub> O <sub>5</sub> )..... | 0.40      |
| Loss on ignition.....                                 | 4.22      |
| Total.....  | 100.01    |

One-half mile southward, this same ledge is exposed at crop in the hill in the rear of the residence of Bishop Whisler, coming there 40 feet by aneroid above an old digging in the Nineveh coal.

This limestone was not observed at any point in Marion county.

Although quite silicious in western Monongalia, it should, however, furnish a fair quality of road material.

### The Nineveh Sandstone.

The next well known formation in descending order in the rock column is the **Nineveh sandstone**, which has been so named<sup>9</sup> from the village of Nineveh, Greene county, Pa., where it attains a good development at 5 to 20 feet above the Nineveh coal. It is yellowish gray and brown in color and furnishes only a fair quality of building stone owing to its sand grains being generally so loosely cemented that it crumbles on exposure to the weather.

In **Monongalia county** its relative position in the rock column is exhibited in the sections for St. Cloud and Maple, pages 92 and 168, respectively. It was once quarried for building purposes on the land of the White Heirs, on the south hillside of Brushy fork, 0.8 mile northeast of Maple. In this region it forms cliffs and prominent bluffs around the hills wherever the latter attain an elevation of 1025 feet and over above that of the Pittsburgh coal as shown by the contours on Map II.

<sup>9</sup> I. C. White, Bull, 65, U. S. G. Survey, page 32; 1891.

In Marion county no quarries were observed on this ledge, but it is a conspicuous bluff former in the central and western portions of Mannington district.

### The Nineveh Coal.

At 5 to 20 feet below the Nineveh sandstone there occurs a very persistent coal in the vicinity of Nineveh, Greene county, Pa., from which place it has been designated the Nineveh coal by J. J. Stevenson. In the area under discussion the crop of this coal is confined to the same area as given for the Nineveh sandstone. Its relative position in the rock column is accurately shown in the sections for St. Cloud and Maple, pages 92 and 168, respectively. The former shows it coming 291 feet below the Windy Gap coal, and 979 feet above the Pittsburgh vein, with a thickness of one foot. It is this bed that crops in the hill road, 0.1 mile southeast of the S. L. S. Spragg No. 1 well (4), 0.5 mile northeast of St. Cloud, Battelle district, at an elevation of 1216' A. T. spirit level, where it is only 6½ inches thick with ½ inch of gray slate one inch below top. Here it comes 984 feet above the Pittsburgh coal as exhibited in the Spragg well (4).

Passing eastward to the hill road ¼ mile southeast of Maple, this coal is found cropping at an elevation of 1262' A. T. spirit level (see Maple section), where it is 12 inches thick, coming 41 feet below the top of the Lower Rockport limestone, 86 feet above the Hostetter coal, and 252 feet above the Jollytown coal. Here the Nineveh-Hostetter coal interval is about 12 feet greater than that in the Burton section, as published by the writer on page 110 of the Marshall-Wetzler-Tyler report of the State Survey.

Three-tenths mile southwestward where this coal crops in the hill road on the head of Browns run, near the residence of William O. Hennen, it has a double-bedded structure, as follows:

|   | Ft. | In. |
|---|-----|-----|
| Shale .....                             |     |     |
| Coal, slaty.....0' 3" } .....           |     |     |
| Shale, gray.....3 6 } Nineveh coal... 4 |     | 3   |
| Coal, slaty.....0 6 } (1265'B-A. T.)    |     |     |
| Shale, dark.....                        | 0   | 4   |

Passing to the extreme southern border of Battelle district, it is found cropping at the foot of the hill road, 0.7 mile southward from St. Leo, at an elevation of 1205' A. T. by aneroid. Here it is only 7 inches thick.

One mile and a half southeastward the coal is found cropping in the hill road on the head of Flat run, 1.6 miles west of Galletin, at an elevation of 1301' L-A; T. Here it is only 5 inches thick and quite slaty.

The writer collected a sample of the Nineveh coal along the western margin of Battelle district where it crops along the hill road on the head of Camp run, 1.4 miles south about 10° east of St. Cloud. There the following section was measured:

|  | Ft. | In. |
|--|-----|-----|
| Sandstone .....                                |     |     |
| Coal, <b>Nineveh</b> .....                     | 1   | 0   |
| Limestone, gray and hard, <b>Nineveh</b> ..... | 1   | 0   |
| Concealed .....                                |     |     |

The composition and calorific value of this sample of coal as reported by Messrs. Hite and Krak, are found under **No. 1** in the table of coal analyses.

About 2 miles southward there occurs an old digging in this vein at an elevation of 1190' B-A. T., just in the rear of the residence of Bishop Whisler, where it comes 40 feet below the Lower Rockport limestone, and 1015 feet above the Pittsburgh coal as exhibited in the Sol. Lemley No. 1 well (49), 0.3 mile northeastward.

With the exception of the exposure noted above on the head of Flat run, the Nineveh coal was not observed in Marion county. The coal is too thin and irregular in either county to have any economic importance, but it has been of great assistance in the correlation of the formations of the Dunkard series above the Fish Creek coal horizon.

### **The Nineveh Limestone.**

The next well-known formation in descending order in the rock column is the **Nineveh limestone**, so designated<sup>10</sup>

<sup>10</sup> I. C. White, Bull. 65, U. S. G. Survey, p. 32; 1891.

from the town of that name in Greene county, Pa. It usually comes 5 to 20 feet under the Nineveh coal.

In **Monongalia county** the crop of this limestone is well exposed in the northwestern corner of Battelle district, near the foot of the hill road on the head of Brushy fork. Here its thickness, character and relation to other formations of the Dunkard series, are exhibited in the St. Cloud section, page 92. The only other point in the county that its crop was observed was along the hill road leading southeast from Crossroads. Its relative position here to other well known formations of the Dunkard rocks is given in the Crossroads section, page 94.

In **Marion county** the only place that its crop was observed was in the railroad cut at the east portal of the Glover Gap tunnel. Its horizon, however, belongs in the hills over practically the same area as that outlined for the Nineveh sandstone.

It contains many minute fossils of apparently fresh water types.

### **The Burton Sandstone.**

At 30 to 40 feet below the Nineveh coal in the vicinity of Burton, Wetzel county, there occurs a great massive sandstone, 30 to 40 feet thick, that has been named the **Burton<sup>11</sup> sandstone** from that place. Its crop in the area under discussion is confined to the western portions of Monongalia and Marion counties. Its thickness, character and relative position in the rock column are exhibited in the sections for Maple, Crossroads, and Daybrook in Monongalia, and for Whetstone Run and Fairview in Marion. It is this stratum that crops at the foot of the hill road near the S. L. S. Spragg No. 1 well (4), 0.6 mile northeast of St. Cloud, Battelle district, Monongalia county. It generally forms a prominent bluff along the hillsides of Dunkard creek and its tributaries eastward to the region of Blacksville. No quarries were observed on this ledge in either county.

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11. Ray V. Hennen, Marshall-Wetzel-Tyler Rept., W. Va. Geol. Sur., p. 182; 1909.

### The Hostetter Coal.

The Hostetter coal of White<sup>12</sup> belongs from a few inches to 5 feet below the base of the Burton sandstone, 75 to 90 feet below the Nineveh coal, 165 feet above the Jollytown coal, and 910 to 920 feet above the Pittsburgh bed. In the northwestern portion of Battelle district, Monongalia, this seam crops along the hill road,  $\frac{1}{4}$  mile due east of Maple, at an elevation of 1176' A. T. by spirit level. Here its thickness and relative position in the rock column are given in the section for the latter place, page 168. About 2.5 miles southwestward it crops a few inches thick along the road on Pone run, 0.6 mile above the mouth of the latter at an elevation of 1135' B-A. T., coming about 70 feet below the Nineveh coal. The only other point its crop was observed was along the hill road near the low gap, 2 miles north  $10^{\circ}$ - $15^{\circ}$  west of Daybrook, where it is only 3 inches thick at an elevation of 1330' A. T. by aneroid, coming about 180 feet above the Jollytown coal cropping 0.4 mile northeastward on Kings run near the Sol Meyers wells. The coal is too thin to have any economic value.

### The Fish Creek Sandstone.

At 40 to 50 feet below the Hostetter coal in the region of Littleton, Wetzel county, there occurs a very massive sandstone that has been named by J. J. Stevenson the **Fish Creek**<sup>13</sup> from its outcrop on a stream of that designation in the southwestern corner of Greene county, Pa. In the area under discussion, its thickness, character and relative position in the rock column are exhibited in the sections for Crossroads, Mooresville and Daybrook. It comes immediately over the Fish Creek coal, and its crop is confined to the western portions of Monongalia and Marion counties. It generally makes a steep bluff around the hillsides about 100 feet above the crop of the Jollytown coal. In the northwestern portion of Battelle district, it is this stratum that crops in the road near the old

12. I. C. White, Bull. 65, U. S. G. Sur.; p. 33; 1891.

13. Ray V. Hennen, Marshall-Wetzel-Tyler Rept.; W. Va. Geol. Sur., p. 185; 1909.



Wm. H. Hennen residence, one-fifth mile southwest of the Eli White No. 1 well (5), where it comes about 820 feet above the Pittsburgh coal. No quarries were observed on this ledge in either county.

### The Fish Creek Coal.

Immediately at the base of the Fish Creek sandstone in the vicinity of Littleton, Wetzel county, there occurs a double-bedded coal, 10 to 18 inches thick, coming 65 feet above the Dunkard coal, and 116 feet above the Jollytown bed, that has been designated the **Fish Creek**<sup>14</sup> from its association with the overlying sandstone. In the area under discussion its thickness and relative position in the rock column are exhibited in the sections for Crossroads, Mooresville and Behler.

The crop of this coal was not observed at any point in Marion county.

In Monongalia, however, it was noted at several places in Battelle and Clay districts. Its slaty blossom shows at the upper edge of the public road, 200 to 300 yards southward from the Hennen school house and 1.7 miles northeast of St. Cloud, at an elevation of 1095' A. T. by aneroid. Southeastward on Shriver run and 1.2 miles due north of Wadestown, its crop is exposed flush with the top of the Geo. Shriver No. 1 well (29), in which the top of the Pittsburgh coal was struck at a depth of 866 feet, giving an accurate measurement for the interval between the two coals. Its crop is also exposed along the road leading up Miller run near the mouth of the latter stream, 1.4 miles west of Wadestown, at an elevation of 1065' A. T. by aneroid. Here it is only 3 inches thick. Passing southeastward 2 miles to the public road on Range run, 1.7 miles due south of Wadestown, this coal—6 inches thick—is found cropping 15 feet above the mouth of the M. J. Garrison No. 2 well (94) at an elevation of 1070' A. T. by aneroid. Its interval above the Pittsburgh coal has thickened here to about 900 feet.

In Clay district it crops along the hill road southeast of

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14. R. V. Hennen, Marshall-Wetzel-Tyler Rept., W. Va. Geol. Sur., p. 187; 1909.

Mooresville at an elevation of 1380' A. T. by aneroid, having there a thickness of only 3 to 4 inches. About the same thickness of this coal is exposed at Behler at an elevation of 1385' A. T. by spirit level. The bed is too thin and irregular to have any economic importance.

### **The Fish Creek Fire Clay Shale.**

Immediately under the Fish Creek coal there nearly always occurs a fire clay shale, ranging in thickness from 5 to 8 feet, which resembles very much in character and texture the Washington fire clay shale as described on page 163 of the Wirt-Roane-Calhoun report of the State Survey. The writer has designated it the Fish Creek fire clay shale on account of its association with the overlying coal. Its thickness and relative position in the rock column are exhibited in the sections for Crossroads, Maple and Fairview. It is a great aid in correlating the Dunkard formations immediately above and below. No sample was collected for analysis, but, like the Washington fire clay shale, it would probably burn into a fair quality of building and paving brick.

### **The Rush Run Sandstone.**

At 30 to 40 feet below the Fish Creek coal and immediately over the Dunkard coal on Rush run, near Hundred, Wetzel county, there occurs a massive sandstone, ranging from 10 to 25 feet in thickness, that has been designated from the latter stream the **Rush Run<sup>15</sup> sandstone**. It resembles very much in character and structure the Fish Creek sandstone above, and was formerly correlated with this ledge by Messrs. White and Stevenson. However, the writer in the reference given in the foot-note shows its true position in the measures. Its crop is confined to the western portions of Monongalia and Marion counties. Its thickness, character and relative position in the rock column in the area under discussion are exhibited in the sections for Crossroads, Whet-

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15. R. V. Hennen, Marshall-Wetzel-Tyler Rept., W. Va. Geol. Survey, p. 191; 1909.

stone Run and Metz. It generally forms a steep bluff around the hillsides 45 to 50 feet above the crop of the Jollytown coal. This ledge was once quarried for building purposes by Michael White near the bed of Dunkard creek, one mile northwest of Maple, where it is medium coarse, gray, micaceous and 15 to 20 feet thick, coming 3 feet above one foot of Dunkard coal in the bed of the creek. It is this stratum that crops in the road at the south end of the highway bridge over the latter stream, one-fourth mile westward.

### The Dunkard Coal.

At 1 to 10 feet below the base of the Rush Run sandstone near the last mentioned locality, there occurs a double-bedded coal, ranging in thickness from 5 to 15 inches, that has been designated by J. J. Stevenson the **Dunkard coal** from the creek at this place. This coal was formerly placed at the base of the Fish Creek sandstone by Messrs. White & Stevenson, but on pages 187-193 of the Marshall-Wetzel-Tyler Report, the writer shows that the coal at the base of the latter sandstone represents a separate and distinct bed. Its thickness and relative position in the rock column in the area under discussion are exhibited in the sections for Mapie, Crossroads and Daybrook in Monongalia, and for Whetstone Run and Fairview in Marion.

In Monongalia it crops in the bed of Dunkard creek, one mile northwest of Maple, on the Fred H. Hennen farm, at an elevation of 1055' A. T. by aneroid. Here it is only 1 foot thick, coming 790 to 800 feet above the Pittsburgh coal, according to the log of the F. H. Hennen well (6), 0.2 mile southward.

One mile southeastward it crops in the bed of Brushy fork, on the land of Levi White, 200 to 300 feet west of the Thos, White No. 1 well (10), flush with the top of the latter, giving an accurate measurement of the Dunkard-Pittsburgh coal interval as 785 feet. (See section for Maple, page 168). Here the Dunkard is 12 inches thick, coming 52 feet by hand-level below the Fish Creek coal horizon, 120 feet below the Hostetter bed, and 206 feet below the Nineveh seam. The

writer collected a sample for analysis at this place, the composition and calorific value of which as reported by Messrs. Hite and Krak are found under No. 2 in the table of coal analyses.

On the north bank of Brushy fork, 150 to 250 feet northeast of the Thos. White well (10), this coal was once mined for blacksmith purposes, but the opening had fallen shut when visited by the writer in 1911.

One mile northeast of Maple its crop is exposed along the road leading southeast from Brushy fork to the head of Pumpkin run at an elevation of 1080' A. T. by aneroid. Here the rock succession below to the Jollytown bed is included in the Maple section, page 168.

About  $3\frac{1}{2}$  miles southeastward on Range run road, 0.6 mile southeast of Wadestown, the Dunkard coal crops at an elevation of 1040' A. T. by spirit level, where the following section is exposed:

|                      | Ft. | In. |
|----------------------|-----|-----|
| Concealed .....      | ..  | ..  |
| Shale .....          | 1   | 0   |
| Coal, Dunkard.....   | 0   | 6   |
| Fire clay.....       | 2   | 0   |
| Sandstone, limy..... | 5   | 0   |

The Dunkard-Pittsburgh coal interval has thickened up southward here to 851 feet as determined from the log of the Lewis Wilson No. 1 well (32), located about 500 feet northeastward. Passing eastward to the hill road leading southeastward from the village of Crossroads, this coal is found cropping at an elevation of 1120' A. T. (See Crossroads section, page 94). Here it is double-bedded, 12 inches thick, carrying 5 inches of gray shale 6 inches above bottom, and coming 46.7 feet below the Fish Creek coal, 62 feet above the Jollytown coal, and 841 feet above the Pittsburgh bed.

In **Marion county** the crop of the Dunkard coal was observed at a number of places. Along the northern boundary of Mannington district its blossom is exposed in the public road near the head of Flat run, 200 to 300 feet north of the Frank Thomas No. 1 well (423), at an elevation of 1145' A. T., 60 feet above an old opening in the Jollytown bed a short distance southeastward.

Mr. Reger reports the blossom of a coal along the pub-

lic road,  $\frac{3}{4}$  mile southeast of Glover Gap at an elevation of 1060' A. T. aneroid, and  $\frac{1}{2}$  mile northeastward from the latter place along the road on Big run at an elevation of 1070' A. T. aneroid, that should correlate with the Dunkard bed, coming as it does about 825 feet above the Pittsburgh coal.

The following section was measured at the crop of this coal along the hill road leading west from Flat run, 1.1 miles northeast of Metz, where it crops at an elevation of 1165' A. T. aneroid:

|                  | Ft. | In. |
|------------------|-----|-----|
| Coal .....       | 0   | 1   |
| Shale, gray..... | 0   | 0½  |
| Coal .....       | 0   | 5   |
|                  | 0   | 6½  |

These are the only places the bed was recognized in Marion county.

The coal is too thin and irregular to have any economic importance.

#### The Jollytown Sandstone.

In the 50 to 60 feet of measures that intervene between the Dunkard coal and the Jollytown vein next below, there frequently occurs a massive sandstone that has been named the **Jollytown**<sup>16</sup> on account of its association with the coal next below. At the type locality of the Jollytown coal on Dunkard creek at Jollytown, Greene county, Pa., and 2 miles westward therefrom, near the residence of J. P. Hagan, this stratum attains a fair development. In the area under discussion, its thickness, character and relative position in the rock column are exhibited in the sections for Maple, Crossroads, Daybrook, and Mooresville, in Monongalia county; and for Metz and Whetstone run, in Marion. Its crop is confined to the western portions of both counties. It generally forms a prominent bluff or escarpment around the hill-sides wherever it comes above drainage. It is this stratum that forms the great cliffs and strews the ground with large

16. R. V. Hennen, Marshall-Wetzel-Tyler Rept., W. Va. Geol. Survey, p. 196; 1909.

boulders on the waters of Days run, 1 mile north and  $\frac{3}{4}$  mile northeast of Daybrook at an elevation of 1170' and 1200' A. T., aneroid, respectively, coming there 795 feet above the Pittsburgh coal, or just above the horizon of the Jollytown coal, the latter being concealed at both places. Here the sandstone is massive, coarse, brown, hard, and 35 to 40 feet thick. No quarries were observed on this ledge, yet, at the place last mentioned it should furnish a fair quality of building stone.

### The Jollytown Limestone.

At 25 to 30 feet below the Dunkard coal in the vicinity of Jollytown, Greene county, Pa., there occurs a limestone. 1 to 2 feet thick, that has been named from that place the **Jollytown**<sup>17</sup>. The crop of this limestone was recognized at only one place in the Monongalia-Marion-Taylor area. This was along the eastern border of Battelle district, Monongalia, at the south edge of the public road, on the land of Alfred Talkington, 1.7 miles north 82° east of Crossroads, where the following section was measured, about 790 feet above the Pittsburgh coal:

|   | Ft. | In. |
|---|-----|-----|
| Slate, black.....                             | 0   | 8   |
| Shale, gray.....                              | 0   | 10  |
| Limestone, dark gray and hard, Jollytown... 1 | 1   | 6   |
| Shale and concealed.....                      | 6   | 0   |
| Coal, Jollytown, 18" to (1085' B-A. T.).....  | 2   | 0   |
| Fire clay and limy shale.....                 | 4   | 0   |
| Limestone, buff, silicious, Upper Washington  | 3   | 0   |
| Concealed .....                               |     |     |

A sample for analysis was collected here from the Jollytown limestone, the composition of which is reported by Messrs. Hite and Krak as follows:

|   | Per cent. |
|---|-----------|
| Silica (Si O <sub>2</sub> ).....                      | 5.57      |
| Ferric Iron (Fe <sub>2</sub> O <sub>3</sub> ).....    | 3.64      |
| Alumina (Al <sub>2</sub> O <sub>3</sub> ).....        | 2.31      |
| Calcium Carbonate (CaCO <sub>3</sub> ).....           | 83.94     |
| Magnesium Carbonate (Mg CO <sub>3</sub> ).....        | 1.95      |
| Phosphoric Acid (P <sub>2</sub> O <sub>5</sub> )..... | 0.26      |
| Loss on ignition.....                                 | 2.10      |
| Total.....  | 99.77     |

17. I. C. White, Bull. No. 65, U. S. G. Survey, page 34; 1891.

The results show this ledge fairly pure and a much better limestone than the Lower Rockport above.

### The Jollytown Coal.

At 45 to 60 feet below the Dunkard coal and directly above the Upper Washington limestone there occurs a persistent, double-bedded coal which has been designated by J. J. Stevenson the **Jollytown** from its crop near the village of that name in Greene county, Pa. On pages 197 and 198 of the Marshall-Wetzel-Tyler Report of the State Survey, the writer gave a section of the bed at its type locality along with a complete analysis of the same and its calorific value.

In the area under discussion the crop of this coal is confined to the western portions of Monongalia and Marion counties. Its interval above the top of the Pittsburgh bed increases both south and east, as will appear from the following table:

Table Showing Jollytown-Pittsburgh Coal Interval.

| Map No.             | Name of Well.           | Location.                           | Feet. |
|---------------------|-------------------------|-------------------------------------|-------|
| (Monongalia County) |                         |                                     |       |
| 13                  | J. P. Hagan No. 1....   | Jollytown, 2 miles west of.....     | 731   |
| 14                  | Hagan Taylor No. 1....  | Jollytown, 1.5 miles west of.....   | 728   |
| 10                  | Thos. White No. 1....   | Jollytown, 2 miles southwest of...  | 739   |
| 21                  | Elza Wade No. 2348...   | Jollytown, 0.8 mile southeast of..  | 750   |
| 24                  | Jas. Hagan No. 1.....   | Wise, 0.6 mile southwest of.....    | 763   |
| 63                  | Eb. Bell No. 4.....     | Bula, 0.9 mile west of.....         | 778   |
| 81                  | Elihu Eddy Heirs No. 6. | Crossroads .....                    | 785   |
| 110                 | Anna Harvey No. 1....   | Galletin, 1.3 miles northeast.....  | 790   |
| 148                 | Sol. Meyers No. 1.....  | Blacksville, 1.3 miles S 10° W of.  | 796   |
| 163                 | John Henderson Heirs    | Daybrook, 0.3 mile southeast of...  | 810   |
| 162                 | Marion Tennant No. 1.   | Daybrook, 1.1 miles southwest of.   | 805   |
| (Marion County)     |                         |                                     |       |
| 398                 | Aaron Furbee No. 1....  | Glover Gap, 1.2 miles southeast of. | 777   |
| 380                 | M. M. Kendall No. 135.  | Seven Pines, 1.4 miles east of....  | 781   |
| 450                 | A. J. Hayes No. 15....  | Rymer, 0.8 mile northeast.....      | 778   |
| 516                 | Michael Kennedy No. 1.  | Mannington, 3 miles southwest of.   | 787   |

The gradual increase of this interval south and east, as exhibited by the above table, is due in a large measure to thickening up in these directions of the intervening Monongahela series.

In the area under discussion, the thickness, character and relative position of this coal in the rock column are shown in the sections for Maple, Crossroads, Daybrook and Behler for Monongalia county; and for Metz and Whetstone Run in Marion.

In **Monongalia county** the Jollytown, next to the Washington, is the most persistent coal of the Dunkard series, where it frequently attains a thickness of two feet. On the northern edge of Battelle district it is this coal that crops 5 to 10 feet above the level of Brushy fork, 200 to 300 feet south of the Hagan Taylor No. 1 gas well (14), where the following section was measured:

|                                     | Ft. | In. |
|-------------------------------------|-----|-----|
| Sandstone, shaly, Jollytown.....    | 8   | 0   |
| Shale .....                         | 5   | 0   |
| Concealed .....                     | 3   | 0   |
| Coal, Jollytown.....                | 1   | 0   |
| Fire clay.....                      | 1   | 0   |
| Limestone, Upper Washington.....    | 2   | 6   |
| Concealed to Brushy fork level..... | 10  | 0   |

As shown by the last table given, it comes 728 feet above the Pittsburgh coal, and, according to the log of the J. P. Hagan No. 2 well (12), 403 feet above the Waynesburg coal.

The following section was measured at its crop along the public road, 0.6 mile southwest of Wise (Wana), near the Jas. Hagan No. 1 well (24), the base of the coal coming 46 feet by hand-level above the well mouth:

|   | Ft. | In. |
|---|-----|-----|
| Shale .....                                 |     | ..  |
| Coal .....0' 11" } Jollytown coal.....      | 1   | 5½  |
| Shale, gray..0 0½ }                         |     |     |
| Coal .....0 5 }                             |     |     |
| Slate, black.....                           | 0   | 3   |
| Fire clay.....                              | 1   | 0   |
| Limestone, silicious, Upper Washington..... | 1   | 0   |
| Concealed .....                             |     | ..  |

Elevation of coal, 1040' B-A. T.; Jollytown-Pittsburgh coal interval, 763 feet.

About three miles southward, this bed was once mined on the land of A. J. Corrothers at Crossroads for local domestic fuel and smelting purposes. The writer collected a sample for analysis from the upper bench of this seam (See Crossroads section, page 94) at its crop in the road on the east



edge of the town, the composition and calorific value of which as reported by Messrs. Hite and Krak are found under No. 3 in the table of coal analyses.

In Clay district the Jollytown coal has been mined quite frequently by farmers for domestic fuel. It is this bed that has been mined by stripping from the run bed at the road fork, 1.4 miles northward from Daybrook and 0.3 mile south-east of the Asa Lemley No. 2 oil well (152), where it has an elevation of 1155' A. T., aneroid. It has also been mined on the east hillside at Daybrook at an elevation of 1195' A. T., aneroid, on the land of Azariah Wilson, coming there about 810' above the Pittsburgh bed. The opening had fallen shut in 1911, so that its thickness could not be measured, but it is reported as being 18 to 24 inches thick, and a fair quality of coal.

An opening occurs in this bed  $1\frac{1}{4}$  miles westward from Daybrook along the south edge of the public road near the Marion Tennant No. 1 well (162), where, according to the log of the latter, the coal comes 805 feet above the Pittsburgh vein. The following section was measured at this mine:

|  | Ft. | In. |
|--|-----|-----|
| Sandstone, massive, Jollytown.....         | 35  | 0   |
| Coal, Jollytown.....                       | 1   | 4   |
| Shale, gray, many fossil plants.....       | 0   | 6   |
| Concealed to M. Tennant No. 1 well (162).. | 9   | 6   |

In Marion county the Jollytown coal crops southwestward entirely across the central and eastern portions of Mannington district. The section for Metz exhibits its thickness and double-bedded nature in that locality. Two miles north-eastward on Flat run, near the Frank Thomas No. 1 well (423), it was once mined at the east edge of the road at an elevation of 1085' A. T., aneroid, 60 feet below the blossom of the Dunkard seam in the road bend to the northeast. The opening had fallen shut so that it was not possible to measure the bed.

Passing southwestward to near the foot of the hill road on the head of Hibbs run, 1 mile southwest of Metz, Mr. Reger reports the blossom of this coal at an elevation of

1120' A. T., aneroid, and at 1105' A. T. aneroid,  $\frac{3}{4}$  mile westward along the Rex run road.

Mr. Reger also reports the blossom of this bed along the road on Buffalo creek at the east edge of Rymer at an elevation of 1055' A. T., and also 0.8 mile northeastward from the latter place along the road on Bartholomew fork, near the A. J. Hayes No. 15 well (450), at an elevation of 1070' A. T., aneroid, coming, according to the log of this boring, 778 feet above the Pittsburgh coal.

Southwestward on the waters of Owen Davy fork, according to Mr. Reger, its blossom shows in the road, 0.5 mile south 50° west of Curtisville at an elevation of 1045' A. T., aneroid; and also in the road on Camp run, 0.7 mile southwest of Curtisville, at an elevation of 1065' A. T., aneroid. He also reports it thin and unimportant in the southern portion of Mannington district. The Whetstone Run section, page 127, gives only 9 inches of slaty coal at this horizon, 49 feet below 3 inches of Dunkard coal, 236 feet above the Washington seam, and 787 feet above the Pittsburgh vein.

In eastern Battelle and western Clay districts, Monongalia county, and in the northwestern portion of Mannington district, Marion, the Jollytown coal may sometime furnish a large tonnage of fairly pure coal, but it is too thin and irregular to compete at this time with the thicker and better coals in the Monongahela series in the same locality. However, it is a very important key rock in correlating the upper Dunkard formations, and for that reason it is of much scientific interest.

### The Upper Washington Limestone.

The Upper Washington limestone of J. J. Stevenson<sup>18</sup> comes from 1 to 5 feet under the Jollytown coal in the region of Jollytown, Greene county, Pa., where it ranges from 1 to 4 feet thick. Where this ledge crops along the public road on Brushy fork in the northern edge of Battelle district, Monongalia, one mile northeast of Maple, it is gray, hard, silicious

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18. J. J. Stevenson, *Sec. Geol. Survey of Pa.*, Vol. K, p. 45; 1875.

and 2½ feet thick, coming only 1 foot below the Jollytown coal and 725 feet above the Pittsburgh coal.

Passing 6 miles southeastward to a point in the public road 1.7 miles north 82° east of Crossroads, 3 feet of this ledge is found exposed 4 feet below the Jollytown coal, as exhibited in the section for this point given on page 94, under the discussion of the "Jollytown Limestone." A sample for analysis was collected here, the composition of which is reported by Messrs. Hite and Krak as follows:

|   | Per cent. |
|---|-----------|
| Silica (Si O <sub>2</sub> ).....                      | 68.00     |
| Ferric Iron (Fe <sub>2</sub> O <sub>3</sub> ).....    | 5.51      |
| Alumina (Al <sub>2</sub> O <sub>3</sub> ).....        | 13.31     |
| Lime (Ca O).....                                      | 3.02      |
| Magnesia (Mg O).....                                  | 1.36      |
| Sodium (Na <sub>2</sub> O).....                       | 1.32      |
| Potassium (K <sub>2</sub> O).....                     | 1.53      |
| Titanium (Ti O <sub>2</sub> ).....                    | 0.28      |
| Phosphoric Acid (P <sub>2</sub> O <sub>5</sub> )..... | 0.16      |
| Moisture .....  | 0.28      |
| Loss on ignition.....                                 | 4.40      |
| Total.....  | 99.17     |

The analysis shows that there is but little lime in the formation at this point.

In the southeastern corner of Battelle district its crop is exposed along the road on Harvey run at the Anna Harvey No. 1 well (110), where the following section was measured:

|   | Ft. | In. |
|---|-----|-----|
| Sandstone, flaggy, Jollytown.....                               | 15  | 0   |
| Shale, sandy.....   | 5   | 0   |
| Black slate...0' 6" } Jollytown coal.....                       | 0   | 8   |
| Coal .....0 2 }   |     |     |
| Fire clay.....  | 1   | 0   |
| Limestone, gray, hard, silicious, Upper<br>Washington .....     | 3   | 0   |
| Shale and concealed to top Anna Harvey<br>No. 1 well (110)..... | 6   | 0   |
| Interval in well to Pittsburgh coal.....                        | 780 | 0   |

In the northwestern corner of Clay district, Monongalia, this ledge has become largely a limy sandstone where its crop is exposed on the Thomas run road, 2½ miles southwest of Blacksville, as exhibited by the Daybrook section, page 169.

One mile and a half southward and 1.2 miles westward

from Daybrook, the following section was measured at the crop of this limestone along the public road:

|  | Ft. | In. |
|--|-----|-----|
| Sandstone, massive, Jollytown.....                     | 40  | 0   |
| Shale .....  | 0   | 4   |
| Coal .....0' 11" } Jollytown coal.....                 | 1   | 1½  |
| Shale, gray..0 0½ } Jollytown coal.....                | 1   | 1½  |
| Coal, slaty..0 2 } Jollytown coal.....                 | 1   | 0   |
| Fire clay.....   | 1   | 0   |
| Limestone, very silicious, Upper Wash-<br>ington ..... | 1   | 0   |

In Marion county the Upper Washington limestone appears to be quite generally absent from the measures. Although its horizon is exposed, it was not observed in the Metz and Whetstone Run sections. It is a very important formation in helping to identify the overlying coal, but owing to its very silicious character it is not of much economic value.

### The Hundred Sandstone.

At 5 to 10 feet under the Upper Washington limestone and about 200 feet above the Washington coal, a massive, bluish and brown sandstone, ranging in thickness from 30 to 40 feet, has been quarried quite extensively for building purposes a short distance west of Hundred, Wetzel county, from which place it has been named the **Hundred<sup>19</sup> sandstone**. In the area under discussion it is quite a prominent cliff former in northeastern Battelle and northwestern Clay districts, Monongalia county. It is this stratum that forms the cliffs along the public road on West Virginia fork of Dunkard, one mile northeast of Wise (Wana), where its base comes at an elevation of 975' A. T., aneroid, 75 feet below an opening in the Jollytown coal, 0.2 mile northwestward. It is this sandstone that forms the bed of Garrison fork at the bridge over same 0.4 mile west of Jollytown, Pa. It also forms the bed of Pennsylvania fork of Dunkard at Hero, Pa., just across the Mason-Dixon line from Battelle district.

Passing on down Dunkard creek into Pennsylvania at

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19. Ray V. Hennen, Marshall-Wetzel-Tyler Rept., W. Va. Geo. Survey, p. 214; 1909.

the northern point of a loop of Dunkard creek to the north, 0.6 mile northeast of the mouth of Hoovers run, the following aneroid section was measured at the crop of this sandstone in a ravine:

|  | Ft. | In. |
|--|-----|-----|
| Sandstone, massive, Jollytown.....           | 30  | 0   |
| Coal, Jollytown, 12" to (1065' B-A. T.)..... | 1   | 6   |
| Fire clay shale.....                         | 3   | 0   |
| Limestone, silicious, Upper Washington....   | 2   | 0   |
| Shale .....                                  | 10  | 0   |
| Sandstone, massive, Hundred.....             | 45  | 0   |
| Fire clay shale.....                         | 15  | 0   |
| Concealed to Dunkard creek level.....        | 50  | 0   |

In the northwestern corner of Clay district, Monongalia, this ledge crops in a cliff on the north bank of Miracle run, opposite the residence of R. S. Thomas, 0.6 mile northeast of Bula. Here it has been quarried for building purposes, furnishing the stone for the steps and foundation of the residence of R. S. Thomas who reports it highly satisfactory. At this quarry a portion of it is quite flaggy and furnishes a fine quality of flagstone. Its base comes at an elevation of 1000' A. T., aneroid, 672 feet above the top of the Pittsburgh coal, according to the log of the R. S. Thomas No. 1 well (131) near by.

In Marion county the Hundred sandstone generally forms a steep bluff around the hillsides, 8 to 10 feet below the Jollytown coal, wherever the latter bed crops 75 to 100 feet above drainage. The Whetstone Run section, page 127, shows this stratum, including 4 feet of shale, to be 49 feet thick, 9 feet below the Jollytown coal, 174 feet above the Washington coal, and 729 feet above the Pittsburgh coal. No quarries were observed on this ledge in Marion county.

### The Hundred Coal.

At the type locality of the sandstone last described there occurs a thin coal, 3 to 4 inches thick, 2 to 5 feet below this sandstone, that has been named the **Hundred**<sup>20</sup> coal from the town of Hundred, Wetzel county. Its relative position in the rock column is exhibited in the section for Metz, page 170.

<sup>20</sup> Ray V. Hennen, Marshall-Wetzel-Tyler Rept., W. Va., Geol. Survey, p. 215; 1909.

In **Monongalia county** coal was observed on the crop of this horizon at only one locality. This was in the north-eastern edge of Battelle district where it crops along the public road on Left branch of Miracle run, 0.5 mile south of Bula, at an elevation of 975' A. T., aneroid. Here the following section was measured:

|                           | Ft. | In. |
|---------------------------|-----|-----|
| Sandstone, Hundred.....   |     | ..  |
| Shale, sandy.....         | 6   | 0   |
| Coal, slaty, Hundred..... | 0   | 2   |
| Fire clay and shale.....  | 5   | 0   |

The coal comes about 700 feet above the Pittsburgh bed.

In **Marion county** the blossom of this coal shows along the public road on Johnnycake run, 0.3 mile northeast of Metz, at an elevation of 1025' A. T., aneroid, coming 55 feet below the Jollytown coal and about 720 feet above the Pittsburgh bed.

About 5 miles southwestward, near the mouth of Bartholomew fork, Mr. Reger reports the blossom of a coal at the edge of the public road, at an elevation of 1020' A. T., aneroid, that appears to correlate with the Hundred vein, coming as it does about 685 feet above the Pittsburgh bed. He also reports the blossom of a coal that seems to come at this horizon 1 mile north 5°—10° east of Logansport, along the road on Long drain.

The coal is too thin and irregular to have any economic value.

### The Upper Marietta Sandstone.

The interval between the Hundred and Washington coals is often occupied by two sandstone ledges, each 30 to 50 feet thick that were designated by I. C. White<sup>21</sup> the **Marietta sandstones** from their occurrence near Marietta, Ohio, where they have long been quarried for grindstones. These have been further designated the **Upper and Lower**<sup>22</sup> **Marietta sandstones**. Their relative position in the Dunkard series is ex-

21. Bull. 65, U. S. G. Survey, page 35-36; 1891.

22. Ray V. Hennen, Marshall-Wetzel-Tyler Rept., W. Va. Geol. Survey, p. 215; 1909.

hibited in the general section of the latter series at the beginning of this chapter.

In the Monongalia-Marion-Taylor area the crop of the Upper Marietta sandstone is confined to the central and western portions of Monongalia and Marion. Its thickness, character and position in the rock column therein are shown by the sections for Mooresville, Mannington and Fairview. It generally forms a steep bluff around the hillsides about 100 feet above the level of the crop of the Washington coal. No quarries were observed on this ledge in either county.

### The Washington "A" Coal.

At the base of the Upper Marietta sandstone and 80 to 100 feet above the Washington coal there occurs an impure coal and coaly shale along Dunkard creek, Monongalia county, in the Blacksville region, that has been designated the **Washington "A"**<sup>23</sup> coal from its association with the coal next below. Its crop is confined to a belt southwestward across the central portions of Monongalia and Marion counties.

In **Monongalia county** the crop of this coal is exposed along the public road in the northern edge of Clay district, 0.3 mile due west of Blacksville at an elevation of 980' A. T., aneroid, where the following section was measured:

|  | Ft. | In. |
|--|-----|-----|
| Sandstone, massive, Upper Marietta.....              | 50  | 0   |
| Shale, concealed and shale.....                      | 6   | 0   |
| Coal, slaty.....0' 3"                                |     |     |
| Slate black.....0 4                                  |     |     |
| Shale, gray, with<br>black slaty<br>streaks .....1 8 |     |     |
| Coal, slaty.....0 5                                  |     |     |
| Fire clay.....                                       |     |     |
|  | 2   | 8   |

Here it comes 600 to 615 feet above the Pittsburgh coal as shown by the records of gas wells in the vicinity.

Passing eastward 2.5 miles to the road on Rudolph run, the following section is exposed near the E. C. Henkins No. 1 well (142), the coal coming at an elevation of 960' A. T.,

23. I. C. White Bulletin 65, U. S. G. Survey, page 35; 1891.

aneroid, 615 feet above the Pittsburgh bed, according to the log of the Henkins well (142):

|  | Ft. | In. |
|--|-----|-----|
| Sandstone, massive, Upper Marietta.....          | 10  | 0   |
| Shale .....                                      | 3   | 0   |
| Slate, black.....                                | 1   | 3   |
| Coal, slaty.....0' 4" } Washington "A" coal..... | 2   | 10  |
| Shale, gray.....2 0 }                            |     |     |
| Coal, slaty.....0 6 }                            |     |     |

Southwestward on Days run, the Washington "A" coal crops along the road, 0.6 miles southwest of the mouth of the latter stream, at an elevation of 955' A. T., aneroid. Passing up Days run to the road fork, 0.7 mile northeast of Daybrook, it occurs on the land of Jesse Headley, at an elevation of 1000' A. T., aneroid, where the following section is exposed:

|  | Ft. | In. |
|--|-----|-----|
| Shale, sandy.....                                | 10  | 0   |
| Coal, slaty.....0' 4" } Washington "A" coal..... | 2   | 4   |
| Slate, black and }<br>limy, hard.....0 3 }       |     |     |
| Slate, black.....0 3 }                           |     |     |
| Slate, gray.....1 2 }                            |     |     |
| Coal, slaty.....0 4 }                            |     |     |
| Fire clay.....                                   |     |     |

At Daybrook the blossom of this coal shows on the east bank of Days run at an elevation of 1013' A. T., spirit level, coming about 110 feet below an old opening in the Jollytown bed. One mile and a half due south of Daybrook, it is this coal that shows along the road, 200 yards southward from the residence of Stephen Mason, at an elevation of 1085' A. T., where only 6 inches of coal is visible.

In Marion county the Washington "A" coal appears to be quite generally absent from the measures, since it was not recognized therein at any point. Even in Monongalia this coal is too thin, slaty and impure to be considered of economic value.

### The Creston Red Shale.

In the interval separating the Upper and Lower Marietta sandstones there generally occurs 20 to 60 feet of dark red shales that have been designated<sup>24</sup> from their fine develop-

24. Ray V. Hennen, Wirt-Roane-Calhoun Rept., W. Va. Geol. Survey, p. 154; 1911.



ment on the "Creston Flats" near the town of Creston in Wirt county. Its thickness and relative position in the rock column are exhibited in the sections for Mannington and Whetstone Run, pages 126 and 127 respectively. While not so well developed here as in Wirt, Roane and Calhoun counties, yet its crop around the hillsides of Clay and Grant districts, Monongalia county, and Pawpaw, Lincoln and Mannington districts, Marion, generally forms a gentle slope or distinct break or bench in the topography. Sometimes these reds are largely replaced by sandy beds.

The **Middle Washington limestone** of Stevenson<sup>25</sup>, belonging near the base of the Creston red shale, was not recognized in this area. However, it may have been inadvertently overlooked, but if present, it must be in poor development not to attract attention.

#### **The Lower Marietta Sandstone.**

Referring to the discussion of the Marietta sandstones in the account given for the Upper Marietta sandstone, page 195, the lower ledge has been designated the Lower Marietta<sup>26</sup>. At its type locality this stratum comes about 5 feet above the Washington coal, and 62 feet below the Upper Marietta sandstone.

In the Monongalia-Marion-Taylor area the crop of this formation is practically the same as that outlined for the Washington coal on Map II. Its thickness and relative position in the series are given in the sections at Mooresville for Monongalia, and on Whetstone Run in Marion county. Like the Upper Marietta ledge it frequently forms a steep bluff around the hillsides. No quarries were observed on this stratum in either county, although it furnishes a fine quality of building stone near Spencer in Roane<sup>27</sup>.

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25. J. J. Stevenson, *Sec. Geol. Survey of Pa.*, Vol. K, p. 49; 1875.

26. Ray V. Hennen, *Marshall-Wetzel-Tyler Rept.*, W. Va. Geol. Survey, p. 217; 1909.

27. Ray V. Hennen. *Wirt-Roane-Calhoun Rept.*, W. Va. Geol. Sur.; p. 155; 1911.

**The Washington "Rider" Coal.**

In Monongalia and Marion counties an impure, thin and slaty coal most generally occurs directly above the Lower Washington limestone, and about 10 feet above the Washington coal. The writer has designated it the **Washington "Rider" coal** on account of its close association with the former bed, and in contradistinction to the Washington "A" vein for which it is frequently mistaken. The following section, measured near the head of Statler run at the north portal of an abandoned railroad tunnel, about a mile and a half northwest of Center (McCurdyville), exhibits its true position in the rock column:

|  | Ft. | In. |
|--|-----|-----|
| Shale, sandy.....  | 7   | 0   |
| Slate, bituminous.1' 3" } Washington "Rider".....              | 1   | 7   |
| Coal, bony.....0 4 }   |     |     |
| Limestone, gray and hard.1' 0" } Lower                         |     |     |
| Shale, limy, gray.....2 0 } Washington                         |     |     |
| Limestone, gray and hard.1 0 } Limestone .....                 | 6   | 9   |
| Shale, gray and limy.....1 6 }                                 |     |     |
| Limestone, gray and hard.1 3 }                                 |     |     |
| Shale, gray.....   | 3   | 0   |
| Coal, slaty....1' 6" } Washington coal.....                    | 2   | 8   |
| Slate, black...0 4 } (1150' B-A. T.)                           |     |     |
| Coal, good....0 10 }   |     |     |
| Slate, dark and gray.....                                      | 4   | 0   |
| Sandstone, flaggy, Washington, to floor of cut for tunnel..... | 5   | 0   |

The base of the section comes about 540 feet above the Pittsburgh coal.

One mile due westward the following section was measured at the crop of the Washington "Rider" coal in the public road, 0.2 mile northeast of Sandy, where it comes 572 feet above the Pittsburgh coal according to the log of the Presley Tennant No. 7 well (195) close by:

|  | Ft. | In. |
|--|-----|-----|
| Sandstone, flaggy.....                     | 5   | 0   |
| Shale, sandy.....                          | 5   | 0   |
| Coal, slaty.....0' 1" } Washington "Rider" |     |     |
| Shale, gray.....1 0 } coal .....           | 4   | 8   |
| Coal, slaty.....0 2 }                      |     |     |
| Shale gray.....0 6 }                       |     |     |
| Limestone, silicious...0 4 }               |     |     |
| Shale, gray.....0 10 }                     |     |     |
| Black, coaly slate.....1 6 }               |     |     |
| Coal .....0 3 }                            |     |     |

|   | Ft. | In. |
|---|-----|-----|
| Limestone, gray and hard, Lower Washington..... | 2   | 0   |
| Coal, Washington.....                           | 2   | 0   |
| Shale, gray.....                                | 0   | 6   |
| Sandstone, Washington.....                      | 2   | 0   |

In Marion county the only locality the Washington "Rider" coal was observed was where its crop is exposed along the public road in the last mile of the lower course of Flat run, 2 miles northward from Mannington. Here 3 feet of black slate interlaminated with coal crops at an elevation of 985' A. T., directly over the Lower Washington limestone, and 520 to 530 feet above the Pittsburgh coal.

Like the Washington "A" coal, 80 to 90 feet above, this bed is too thin, slaty and impure ever to be mined successfully.

### The Lower Washington Limestone.

The Lower Washington limestone of Stevenson<sup>28</sup> comes immediately above the Washington coal, and 225 to 250 feet below the Upper Washington limestone. Its thickness, character and relative position in the rock column in Clay district, Monongalia, are exhibited in the sections given on pages 199 and 200 in connection with the Washington "Rider" coal.

In the northern portion of the district, this limestone with its shale layers is about 4 feet thick where its crop is exposed along the public road, 0.5 mile northwest of Mooresville. Here its top comes 67 feet by hand-level below the top of the D. C. Core No. 1 well (170) in which the top of the Pittsburgh coal was struck at a depth of 624 feet, placing the limestone 553 feet above the latter coal.

A sample for analysis was collected from this ledge, the composition of which is reported by Messrs. Hite and Krak as follows under Laboratory No. 616H:

|   | Per cent. |
|---|-----------|
| Silica (Si O <sub>2</sub> ).....                      | 17.55     |
| Ferric Iron (Fe <sub>2</sub> O <sub>3</sub> ).....    | 2.61      |
| Alumina (Al <sub>2</sub> O <sub>3</sub> ).....        | 1.42      |
| Calcium Carbonate (CaCO <sub>3</sub> ).....           | 72.62     |
| Magnesium Carbonate (Mg CO <sub>3</sub> ).....        | 2.16      |
| Phosphoric Acid (P <sub>2</sub> O <sub>5</sub> )..... | 1.17      |
| Loss on ignition.....                                 | 1.50      |
| Total.....  | 99.03     |

28. J. J. Stevenson, Sec. Geol. Survey of Pa., Vol. K, p. 45; 1875.

It attains a fine development on Doll run, 0.4 mile north-west of Core as appears in the Kate Core Mine section, given on a subsequent page in the description of the Washington coal.

In Marion county the crop of the Lower Washington limestone was recognized at only one locality. This was along the last mile of the lower course of Flat run, 2 miles northward from Mannington, where the following section was measured:

|   | Ft. | In. |
|---|-----|-----|
| Sandstone, shaly, Lower Marietta.....                         | 10  | 0   |
| Shale, sandy.....   | 10  | 0   |
| Black slate with streaks of coal, Washington<br>"Rider" ..... | 3   | 0   |
| Limestone, gray and hard.1' 6" } Lower Washing-               |     |     |
| Shale, gray and limy.....1 3 } ton Limestone..                | 4   | 3   |
| Limestone, gray and hard 1 6 } (985' B-A. T.)                 |     |     |
| Shale, dark gray, with limestone nuggets at top.....          | 7   | 0   |
| Sandstone, massive.....                                       | 1   | 0   |
| Shale, dark.....  | 1   | 0   |
| Coal .....0' 5" }   |     |     |
| Black slate.....3 0 } Washington coal....                     | 6   | 5   |
| Concealed to Flat run..3 0 }                                  |     |     |

The section is almost typical of that at this horizon as found at the north portal of the abandoned tunnel, as given under the account of the Washington "Rider" coal on a preceding page.

The limestone is quite hard and appears to possess fair cementing properties, and for that reason would make road material, although limited in quantity.

### The Washington Coal.

At 1 to 5 feet under the Lower Washington limestone there occurs a multiple bedded coal seam with the purest coal in its basal portion, that has been designated the **Washington coal** by White and Stevenson from its fine development near Washington, Pa. Previously, however, it had been called the Brownsville coal by White<sup>29</sup> from a village of that name in Monongalia county, West Virginia, near which it had been mined by farmers for local domestic fuel and smithing purposes.

29. I. C. White, Bull. No. 65, U. S. G. Survey, p. 37; 1891.

In Monongalia and Marion counties it is by far the most important coal from an economic standpoint in the Dunkard series. Its crop therein is outlined in detail on Map II, and as thereon exhibited is confined to a belt about 10 miles wide southwestward entirely across both counties.

**Monongalia County.**—In Monongalia the thickness and relative position of the Washington coal to other formations of the Dunkard series are exhibited in the sections for Mooresville and Behler, pages 96 and 97 respectively.

Passing down the Dunkard creek road to Pentress, this coal first makes its appearance above drainage on the east side of the creek where its blossom shows at an elevation of 938' A. T., spirit level. Three-fourths mile southeastward this vein was once mined on the south bank of Dunkard opposite Worley (Browns Mills), at an elevation of 986' A. T., spirit level. The opening had partly fallen shut in 1911, so that it was not possible to obtain a section of the coal, but I. C. White gives a complete section of the bed as exhibited at this mine on page 114 of Vol II of the State Survey reports.

One mile southeast of Worley this bed has been opened on the east side of the public road on Statler run on the land of Brown et al., at an elevation of 985' A. T., aneroid where the following section was measured:

**Geo. C. Wright Mine—No. 4 on Map II.**

|                              | Ft.                 | In.      |
|------------------------------|---------------------|----------|
| Slate roof.....              |                     |          |
| Coal, upper bench.....1' 2"  |                     |          |
| Slate, dark gray.....0 5     |                     |          |
| Coal .....0' 8" } lower      | Washington coal.... | 3      7 |
| Coal, better.....1 4 } bench |                     |          |
|                              |                     |          |
|                              | 2 0                 |          |
| Fire clay.....               | 4                   | 0        |

Mr. Wright has this mine leased paying a royalty of \$1.50 for each 100 bushels of coal mined. He sells coal on the dump at 5 cents a bushel to the farmers of the surrounding region, and reports the bottom 16 inches a very excellent smithing coal, selling it to blacksmiths for 8 cents a bushel. Separate samples were collected from the upper (Laboratory No. 614H) and lower (615H) benches, the composition and calori-

fic value of which as reported by Hite and Krak are found under No. 4 in the table of coal analyses.

It is the Washington coal that has been mined quite extensively for local domestic fuel near the eastern border of Clay district on the Kate Core farm, 0.4 mile northwest of Core, at an elevation of 970' A. T., aneroid, where the following section was measured at the mine entrance:

**Kate Core Mine.**

|   | Ft.                                     | In. |
|---|---|-----|
| Sandstone, massive, Lower Marietta..... | 10                                      | 0   |
| Concealed .....                         | 10                                      | 0   |
| Limestone, gray and hard..2' 0"         | } Lower<br>Washington<br>Limestone .... |     |
| Shale, gray and limy.....0 10           |   |     |
| Limestone, gray and hard..0 10          |   |     |
| Shale, gray and limy.....2 0            |   |     |
| Limestone, gray and hard..0 8           |   |     |
| Shale, gray.....                        | 2                                       | 6   |
| Coal .....                              | } Washington<br>coal.....               |     |
| Slate with streaks of coal..0 6         |   |     |
| Coal .....                              |   |     |
| Shale, dark.....0 3½                    |   |     |
| Coal .....                              |   |     |
| Slate, black.....0 6                    |   |     |
| Coal .....                              |   |     |
| Coal .....                              | 2                                       | 4   |
| Fire clay.....                          | 1                                       | 0   |
| Concealed .....                         |   |     |

The section is very interesting in that it exhibits a fine development of the Lower Washington limestone and the relative position of the latter with respect to the Lower Marietta sandstone and the Washington coal. The latter vein is in typical development and carries almost 5 feet of coal exclusive of partings. The mine was not being operated in 1911, but it has furnished much coal for local domestic trade which sold on the dump at 4½ cents a bushel.

Passing 3.5 miles southwestward, this coal is found opened on the land of P. W. Moore, 0.2 mile southwest of Statler Run village, at an elevation of 1059' A. T., spirit-level, where the following section was measured:

**P. W. Moore Mine.**

|                          | Ft.                    | In. |
|--------------------------|------------------------|-----|
| Concealed and shale..... |                        |     |
| Coal .....               | } Washington coal..... |     |
| Shale, gray.....0 8      |                        |     |
| Coal .....               |                        |     |
| Coal .....               |                        |     |
| Concealed .....          | 4                      | 2   |

A more complete section of the bed is exhibited at an opening on the land of Nimrod Tennant, 0.3 mile southeast of Statler Run village, where the coal crops at an elevation of 1075' A. T., aneroid. A section here shows the following:

### Nimrod Tennant Mine.

|  | Ft. | In. |
|--|-----|-----|
| 1. Shale, dark, with limestone nodules.....    | 8   | 0   |
| 2. Slate, black with coal streaks .....1' 6" } |     |     |
| 3. Coal, bony.....0 10 }                       |     |     |
| 4. Shale, dark.....0 4 } Washington coal.....  | 6   | 10  |
| 5. Coal .....1 4 }                             |     |     |
| 6. Shale, dark, 1" to..0 2 }                   |     |     |
| 7. Coal .....2 8 }                             |     |     |
| 8. Fire clay.....                              | 1   | 0   |

That portion of the bed represented by formations Nos. 5 and 7 of the section is the best part of the vein, and is generally the only portion taken out by farmers.

**Marion County.**—In Marion county the thickness, character and relative position of the Washington coal in the rock column are exhibited in the sections given on preceding pages for Glover Gap, Mannington, Whetstone Run, Fairview, Dakota, Downs, Monongah N. W., Barracksville and Ices Run.

The following section was measured at the crop of this coal on a branch of Bennefield prong in the northwestern portion of Pawpaw district 0.7 mile north of Fairview:

|                                    | Ft. | In. |
|------------------------------------|-----|-----|
| Concealed .....                    |     |     |
| Coal, slaty.....1' 0" }            |     |     |
| Slate, gray.....0 5 }              | 3   | 11  |
| Coal, slaty.....2 6 }              |     |     |
| Fire clay shale, Washington.....   | 7   | 0   |
| (Elevation of coal, 1085' B-A. T.) |     |     |

In this region, according to the Fairview section, page 129, the Washington coal comes 172 feet above the Waynesburg coal and 555 feet above the Pittsburgh bed.

Five miles southeastward D. B. Reger obtained the following section of this coal along the public road, 0.5 mile southward from Grays Flat, where it crops at an elevation of 1250' A. T., aneroid:

|   | Ft.                    | In.      |
|---|------------------------|----------|
| Shale and slate.....                            | 3                      | 0        |
| Coal, slaty.....1' 4"                           | } Washington coal..... | 3      0 |
| Shale, gray.....0 2                             |                        |          |
| Coal, good.....1 6                              |                        |          |
| Fire clay shale, Washington, greenish gray..... | 5                      | 0        |

The section is almost typical of that for the same bed in southeastern Doddridge county.

One mile southwest of Farmington, Reger collected a sample for analysis and measured the following section at the crop of the Washington coal on the head of Helens run:

|                                    | Ft.                    | In.       |
|------------------------------------|------------------------|-----------|
| Slate, black.....                  |                        |           |
| Coal, slaty.....2' 0"              | } Washington coal..... | 3      11 |
| Slate, black.....0 2               |                        |           |
| Coal, good.....1 9                 |                        |           |
| Fire clay .....                    |                        |           |
| (Elevation of coal, 1215' B-A. T.) |                        |           |

The composition and calorific value of the sample from the lower bench only as reported by Messrs. Hite and Krak, are found under **No. 5** (Laboratory No. 643H) in the table of coal analyses at the end of the chapter on Coal.

Along the southern border of Mannington district the Washington coal has been opened at an elevation of 1075' A. T., aneroid, on the north side of Glade run, 0.4 mile northwest of Pleasantville, according to Mr. Reger who measured the following section there:

|                           | Ft.                | In.      |
|---------------------------|--------------------|----------|
| Shale .....               | 5                  | 0        |
| Coal, soft, slaty...1' 0" | } Washington ..... | 4      4 |
| Shale, gray.....0 10      |                    |          |
| Coal, hard, bony.2 6      |                    |          |

The coal comes 70 feet by hand-level above the top of the Daniel Mason No. 1 well (540), making the Washington-Pittsburgh coal interval 545 feet. Ten to eleven miles eastward the same interval is 552 feet, according to the accurate Monongah N. W. section, page 137.

A further discussion of the character, quality and probable available area and tonnage of the Washington coal will be given on subsequent pages in the chapter on Coal.



### The Washington Fire Clay Shale.

Immediately below the Washington coal there occurs a yellowish green and impure fire clay shale that has been designated the **Washington**<sup>30</sup> from its association with the overlying coal. On page 163 of the Wirt-Roane-Calhoun report and 168 of the Doddridge-Harrison report of the State Survey, is given a chemical analysis of this fire clay shale as found at Spencer, Roane county.

In Monongalia and Marion counties this fire clay shale accompanies the Washington coal, and may be observed wherever the crop of the latter is exposed. It ranges in thickness from 5 to 10 feet, and is of great aid in ascertaining the horizon of the overflowing coal where the latter is often concealed by debris.

### The Washington Sandstone.

The **Washington sandstone** of I. C. White<sup>31</sup> is quite generally present in Monongalia county. The following section measured on the east edge of the public road on Dolls run, 0.5 mile northward from Core, exhibits the relative position of this stratum to the Washington fire clay shale, Little Washington coal, and the Bristol limestone<sup>32</sup>, and corrects some slight errors of position of the latter in former reports:

|  | Ft.       | In.      |
|--|-----------|----------|
| Coal, Washington.....                          | 4         | 0        |
| Fire clay shale, Washington and concealed..... | 6         | 0        |
| <b>Sandstone, massive, Washington</b> .....    | <b>10</b> | <b>0</b> |
| Shale, dark.....                               | 3         | 0        |
| Coal .....0' 1" }                              |           |          |
| Shale, sandy.....1 0                           |           |          |
| Coal .....0 5   <b>Little Washington coal.</b> | 5         | 2        |
| Sandstone, massive..3 0                        |           |          |
| Shale .....0 6                                 |           |          |
| Coal .....0 2 ]                                |           |          |
| Fire clay shale.....                           | 7         | 0        |
| Limestone, silicious, Bristol.....             | 3         | 0        |
| Concealed to Dolls run level.....              | 17        | 0        |

30. Ray V. Hennen, Wirt-Roane-Calhoun Rept., p. 163-164; W. Va. Geol. Sur.; 1909.

31. Bull. 65, U. S. G. Survey, p. 38; 1891.

32. Ray V. Hennen, Doddridge-Harrison Rept., pp. 168-169; W. Va. Geol. Sur.; 1912.

No quarries were observed on this ledge in either Monongalia or Marion. The ledge does not appear to exceed 10 to 15 feet in thickness at any point.

**The Little Washington Coal.**

At 10 to 20 feet below the Washington coal in southwestern Pennsylvania there occurs a thin coal that has been designated the **Little Washington** from its association with the coal next above. The section above given shows that in Monongalia it belongs 19 feet below the Washington bed, between the Washington sandstone and the Bristol limestone. It appears to be quite generally present in the northeast portion of Clay district, Monongalia, and it is this bed that crops at the bend of the road, 0.5 mile northeast of Worley, at an elevation of 930' A.T., aneroid, where it is only 10 inches thick.

One-half mile southeastward it crops at the road fork, 0.2 mile west of the mouth of Statler run, at an elevation of 945' A.T., spirit level, and also along the road leading up the latter run, opposite the Geo. C. Wright mine (No. 4 on Map II) in the Washington coal, coming about 25 feet below the latter vein. Its section there is as follows:

|                      | Ft.   | In.                          |
|----------------------|-------|------------------------------|
| Shale .....          |       |                              |
| Coal .....           | 0' 3" |                              |
| Shale, gray .....    | 0 4   | } Little Washington..... 0 9 |
| Coal, slaty .....    | 0 2   |                              |
| Fire clay shale..... |       |                              |

Southeastward along the hill road leading northwest from Pedlar run, 0.6 mile southwest of Core, both the Little Washington and Washington coals are exposed, where the following section was measured:

|   | Ft.                              | In. |
|---|----------------------------------|-----|
| Coal, Washington (1030' A. T.).....                 |                                  |     |
| Fire clay shale, Washington.....                    | 1                                | 0   |
| Sandstone, flaggy, with shale layers, Washington... | 10                               | 0   |
| Shale, dark, with streaks of black slate.....       | 7                                | 4   |
| Coal, slaty.....0' 6"                               | } Little Washington coal.... 5 8 |     |
| Sandstone, shaly..5 0                               |                                  |     |
| Coal .....  |                                  |     |

It crops at an elevation of 930' A.T., aneroid, at the bridge over Dolls run, 0.2 mile southwest of the mouth of the latter

stream, and it is this bed that crops in the road near its fork, 0.5 mile northeastward, at an elevation of 940' A.T., aneroid, where it is 12 inches thick. It appears to thin away southwestward in Marion county, and in the area under discussion is too thin and irregular to have any economic value.

### The Bristol Limestone.

At 10 to 15 feet below the Washington coal near Bristol, Harrison county, there occurs 4 feet of hard gray limestone that has been named from that village the **Bristol**<sup>33</sup> limestone. In the Monongalia-Marion-Taylor area, the crop of this limestone was recognized at only one place. This was along the public road on Dolls run, 0.5 mile northward from Core, Clay district, Monongalia, and its thickness, character and relative position in the rock column are exhibited in the section given on a preceding page under the discussion of the Washington sandstone. On pages 134-135 of the Doddridge-Harrison report of the State Survey, the writer is evidently in error in placing the Bristol limestone above the Washington sandstone and Little Washington coal, since the section given under the discussion of the Washington sandstone shows the limestone coming below both these formations. The limestone is too thin, silicious and irregular to be considered an economic asset for Monongalia and Marion counties.

### The Mannington Sandstone.

The **Mannington sandstone** of Grimsley<sup>34</sup> does not appear to be very well represented in Monongalia county, but in Marion it attains a fine development. Its thickness, character and relative position in the rock column in the latter area are exhibited in the sections given on preceding pages for Mannington, Rivesville, Dakota, Monongah N. W., and Barrackville. Its crop therein follows closely the same area as that outlined for the Washington coal on Map II, and in Marion it generally forms a prominent bluff around the hillsides

33. Ray V. Hennen, Doddridge-Harrison Rept., W. Va. Geol. Survey, pp. 168-9; 1912.

34. G. P. Grimsley, Vol. IV, W. Va. Geol. Survey, p. 440; 1906.





**PLATE XIII(a).**—Topography of the Dunkard Series, with view of Mannington and oil wells.



**PLATE XIII(b).**—The Rosetti quarry in the Mannington Sandstone at Dakota, Marion County.

wherever the latter coal crops 50 feet or more above drainage. On pages 440-441 of Vol. IV of the State Survey reports, G. P. Grimsley gives a section of this stratum at its type locality at the J. D. Charlton quarry in the west edge of Mannington. Its relative position with respect to the Washington and Waynesburg "A" coals is shown in the Mannington section, page 126.

It is this stratum that has been quarried for ballast by J. P. Rosetti high up the west hillside of the Monongahela river, one mile southwest of Rivesville, as exhibited in the Dakota section, page 131. Here Mr. Reger reports it steel gray in color, weathering brown, medium grained, hard, micaceous, 23 feet thick, 60 feet below the Washington coal and 72.5 above the Waynesburg bed. No attempt has been made to quarry it for building purposes, according to Reger who reports the irregularities of the bedding and joint planes as making it unsuitable for anything but rough work.

The Waynesburg "B" coal of Stevenson and the Colvin Run limestone of White<sup>35</sup> were not recognized in either Marion or Monongalia.

### The Waynesburg "A" Coal.

At 75 to 90 feet above the Waynesburg coal and 5 to 20 feet below the base of the Mannington sandstone there occurs a very persistent bed in Monongalia and Marion counties that has been designated the Waynesburg "A" coal by J. J. Stevenson<sup>36</sup>.

In Monongalia county its crop is confined to a belt tending southwestward through Cass, Grant and the southeastern portion of Clay districts. In the northwest corner of Cass district this bed crops along the public road, 0.4 mile southeast of the last intersection of Dunkard creek with the W. Va.-Pa. State line, at an elevation of 945' A.T., aneroid, where the following section was measured:

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35. I. C. White, Bull. 65. U. S. G. Survey, page 39; 1891.

36. Report K, Sec. Geol. Survey, Pa., pp. 45 and 56.

|  | Ft. | In. |
|--|-----|-----|
| Sandstone, flaggy and shaly, Mannington..... | 15  | 0   |
| Slate, sandy.....                            | 2   | 0   |
| Shale, dark.....                             | 0   | 6   |
| Coal, Waynesburg "A".....                    | 0   | 10  |
| Limestone, gray and hard, Mt. Morris.....    | 1   | 0   |
| Fire clay.....                               |     |     |

The following section was obtained at the crop of this coal in the northern edge of Grant district along the public road westward from the residence of Ray Hess, 1.7 miles southwest of Charlotte:

|   | Ft. | In. |
|---|-----|-----|
| Shale .....                                 |     |     |
| Coal, slaty.....0' 10" } .....              |     |     |
| Shale, gray.....0 2 } Waynesburg "A" coal.. | 1   | 10  |
| Coal .....0 10 } .....                      |     |     |
| Fire clay.....                              |     |     |
| Elevation of coal, 1255' A. T., aneroid.    |     |     |

Here it comes about 75 feet above an opening in the Waynesburg coal.

In the southeast portion of Clay district this coal crops along the public road at an elevation of 1038' A. T., spirit-level, 0.2 mile northwest of Center (McCurdyville), where the following section was measured:

|  | Ft. | In. |
|--|-----|-----|
| Sandstone, massive, Mannington.....    | 10  | 0   |
| Shale, sandy.....                      | 5   | 0   |
| Coal .....0' 3" } .....                |     |     |
| Shale .....0 1 } Waynesburg "A" coal.. | 2   | 2   |
| Coal .....1 10 } .....                 |     |     |
| Fire clay.....                         | 5   | 0   |
| Concealed .....                        | 5   | 0   |
| Limestone, Mt. Morris.....             |     |     |

It is this bed that crops one-fifth mile southeast of McCurdyville along the road just north of the A. S. Kennedy No. 1 well (576), where, according to the log of the latter, it comes about 440 feet above the Pittsburgh coal.

In **Marion county** the thickness, character and relative position of the Waynesburg "A" coal in the rock column are exhibited in the sections given on preceding pages for Mannington, Fairview, Rivesville, Downs and Barrackville.

The following section was measured at the crop of this coal on the north bank of Buffalo creek at the western edge of Mannington:

|   | Ft. | In. |
|---|-----|-----|
| Sandstone, massive, Mannington.....           | 35  | 0   |
| Shale, sandy.....                             | 35  | 0   |
| Limestone, ferriferous, shaly.....            | 0   | 10  |
| Shale, dark.....                              | 3   | 0   |
| Coal, slaty.....0' 4" } Waynesburg "A" coal.. | 2   | 0   |
| Coal, good.....1 8 } (980' B.A. T.)           |     |     |
| Slate, black.....                             | 0   | 2   |
| Fire clay shale.....                          | 10  | 0   |

Three-tenths mile northeastward on the west bank of Pyles fork, in the northwest edge of Mannington, Reger collected a sample for analysis and measured the following section at the crop of the Waynesburg "A" coal:

|  | Ft. | In. |
|--|-----|-----|
| 1. Sandstone, massive, Mannington.....               | 30  | 0   |
| 2. Shale, silicious, hard, brown.....                | 20  | 0   |
| 3. Shale, dark with ferriferous limestone nuggets... | 6   | 0   |
| 4. Coal, slaty.....0' 3" }                           |     |     |
| 5. Slate, black.....0 0¼ }                           |     |     |
| 6. Coal, good.....0 11 } Waynesburg "A" coal         |     |     |
| 7. Slate, black.....0 0¼ } Elevation, 987' L-        |     |     |
| 8. Coal, good.....0 6 } A. T.).....                  | 2   | 3   |
| 9. Slate, black.....0 0½ }                           |     |     |
| 10. Coal, hard, bony.0 6 }                           |     |     |
| 11. Fire clay shale.....                             | 10  | 0   |
| 12. Concealed to Pyles fork level.....               | 15  | 0   |

The composition and calorific value of the sample collected from formations Nos. 6, 7, 8 and 10 of the section as reported by Messrs. Hite and Krak are found under No. 6 (Laboratory No. 644H) in the table of coal analyses at the end of the chapter on Coal.

Mr. Reger reports an old abandoned coal opening on the Felix Cunningham farm in the southeast portion of Lincoln district,  $\frac{3}{4}$  mile south of Festus, 19 feet by hand-level below the top of the Felix Cunningham No. 2269 gas well (649). that evidently correlates with the Waynesburg "A" bed, coming as it does, according to the log of the latter well, 481 feet above the Pittsburgh coal, since in this region the thickness of the Monongahela series is slightly over 400 feet as shown by diamond drill borings. Mr. Reger was unable to ascertain the thickness, but Mr. Cunningham reported the bed as carrying a parting with the best coal in the bottom bench.

Three miles northeastward and 0.2 mile northwest of the J. L. Jones Core Test No. 2 (660), this coal crops by the road-



side, at an elevation of 1220' A. T., aneroid. Here only 12 inches of coal is visible.

Like the Jollytown coal, 300 feet higher in the measures, the Waynesburg "A" bed may sometime furnish quite a large tonnage of fairly pure coal in Monongalia and Marion counties, but it is too thin, impure, and irregular to compete with the thicker and better coals in the same region at present.

#### **The Mount Morris Limestone.**

At 2 to 5 feet below the Waynesburg "A" coal in the vicinity of Mt. Morris, Greene county, Pa., there occurs a limestone 1 to 2 feet thick, that has been so designated from this place the **Mt. Morris limestone** by I. C. White<sup>36</sup>.

In the area under discussion this limestone was recognized at only two places, both of which were in Monongalia county. The sections given on preceding pages for the Waynesburg "A" coal at the northwest corner of Cass district and the southeast corner of Clay, report this stratum. It is too thin and irregular to have any economic value.

#### **The Waynesburg Sandstone.**

At 1 to 10 feet above the base of the Dunkard series and 15 to 20 feet below the Waynesburg "A" coal there occurs a great massive, gray and brown, sometimes pebbly sandstone, ranging in thickness from 20 to 50 feet, that was designated by the First Geological Survey of Penna. the **Waynesburg sandstone** from the town of that name in Greene county, where it attains a fine development. The thickness, character and relative position of this stratum in the rock column are exhibited in the sections given on preceding pages for Mooresville and Cassville in Monongalia county; and for Glover Gap, Mannington, Rivesville, Farmington, Downs, Worthington, Monongah N. W., Barrackville, Ices Run, and Monongah S. E. for Marion county. Its outcrop in the two counties follows practically the same areas as that outlined for the Waynesburg coal on Map II.

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36. Bull. 65, U. S. G. Survey, pages 39-40; 1891.



PLATE XIV(a).—"Watson Rock," a remnant of the Waynesburg sandstone, capping a high hill  $1\frac{1}{2}$  miles southeast of Monongah.



PLATE XIV(b).—Waynesburg and Gilboy Sandstones at Downs, Marion County.

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No quarries were observed on this ledge in **Monongalia**, but in **Marion county** it has been quarried at several different points for bridge piers, foundations and buildings. It is this stratum that is quarried on Bennefield prong in the north edge of Fairview by John Statler, at an elevation of 1025' A.T., aneroid. It is also this ledge that is quarried on the west side of Little Pawpaw creek, one mile south of McCurdyville, by Benjamin S. Wilson, at an elevation of 1040' A.T., aneroid. Near Mine No. 8 of the Jamison Coal & Coke Company,  $\frac{3}{4}$  mile eastward from Farmington, this sandstone crops near the shaft mouth, where it has been quarried by the company to furnish stone for the power house. The same company has quarried this stratum, according to Reger, at its No. 7 mine,  $\frac{3}{4}$  mile southwestward from Barrackville. It is this sandstone that caps the summit of "Watson Knob" in a lone column, 25 feet high,  $\frac{1}{2}$  mile southeast of Monongah, as exhibited in the Monongah S. E. section, page 142.

In the early days of the oil and gas development within the area under discussion, it was called the "Bluff Sand" by the oil well drillers.

#### The Elm Grove Limestone.

The **Elm Grove limestone** of Grimsley<sup>37</sup> was recognized at only one point within the three counties. This was in the extreme northern edge of Pawpaw district, Marion county, on Little Pawpaw creek, near the road fork, 0.5 mile southeast of McCurdyville, where 3 feet of dark gray limestone is exposed at an elevation of 1025' A.T., aneroid, at about 10 feet above the Waynesburg coal. A sample for analysis was collected, the composition of which is reported by Messrs. Hite and Krak as follows:

|   | Per cent.    |
|---|--------------|
| Silica (Si O <sub>2</sub> ).....                      | 11.70        |
| Ferric Iron (Fe <sub>2</sub> O <sub>3</sub> ).....    | 1.63         |
| Alumina (Al <sub>2</sub> O <sub>3</sub> ).....        | 1.82         |
| Calcium Carbonate (Ca CO <sub>3</sub> ).....          | 78.78        |
| Magnesium Carbonate (MgCO <sub>3</sub> ).....         | 1.38         |
| Phosphoric Acid (P <sub>2</sub> O <sub>5</sub> )..... | 0.50         |
| Loss on ignition.....                                 | 3.70         |
| <b>Total.....</b>                                     | <b>99.51</b> |

37. G. P. Grimsley, Ohio-Brooke-Hancock Rept., W. Va. Geol. Surv., p. 68; 1906.

The results reveal a limestone fairly high in silica, but adapted to agricultural purposes and road material.

### The Cassville Plant Shale.

The Cassville Plant Shale is the first and lowest member of the Dunkard series, and has been so designated by Messrs. Fontaine and White<sup>38</sup> from the village of that name in Monongalia county, West Virginia, where it is 0 to 20 feet in thickness and full of fossil plants and insects. The reader is referred to pages 119 to 123 inclusive of Vol. II of the State Survey reports for a full description of this shale at its type locality, and the fossil flora therein.

In the area under discussion its thickness, character and position in the rock column are exhibited in the sections given on preceding pages for Cassville in Monongalia, and for Fairview, Rivesville, Downs, Worthington, Monongah N. W., and Ices Run in Marion county.

In the latter county, Mr. Reger reports fossil plants abundant at this horizon at the quarry of the Jamison Coal & Coke Company in the Waynesburg sandstone,  $\frac{3}{4}$  mile southwestward from Barrackville.

### AGE OF THE DUNKARD SERIES.

The lack of a Permian reptilian fauna in the Dunkard rocks has inclined geologists to place these measures in the true Carboniferous, but the fact that its formations are largely of fresh water origin would tend to show that the absence of such types should be expected. On pages 69-77 inclusive of the Ohio-Brooke-Hancock report of the State Survey, G. P. Grimsley gives an interesting account of the age of the Dunkard series as discussed by geologists in other publications along with an account of the fossil flora of the Dunkard rocks in Ohio county. From all the evidence yet collected the series evidently belongs either in the lower Permian of Europe, or in the Permo-Carboniferous.

<sup>38</sup> Report PP, Sec. Geological Survey of Penna.



PLATE XV.—Waynesburg Coal, Barker mine, at Georgetown, Monongalia County.

Photo by Ray Bricker.

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## CHAPTER VI.

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### STRATIGRAPHY—MONONGAHELA SERIES.

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The Monongahela series of the Upper Carboniferous rocks begins at base with the bottom of the Pittsburgh coal seam and extends up to the base of the Cassville Plant shale, or to the top of the Waynesburg coal. The series was so named by H. D. Rogers from the Monongahela river in the State of Pennsylvania, along which its coal beds attain a fine development. The thickness of this group of rocks in West Virginia ranges from 260 feet along the western borders of Ohio and Marshall counties, to over 435 feet in southeastern Doddridge and southwestern Harrison counties. The greater portion of the series in southwestern Pennsylvania and in the bordering counties of Brooke, Ohio, Marshall and Monongalia in West Virginia is limestone, but southwestward across the latter area, many of the limestone ledges are replaced by heavy sandstones and red beds. For a more detailed description of these beds in other portions of the State the reader is referred to pages 124-125 of Vol. II of the W. Va. Geol. Survey reports.

The following general section of the Monongahela series for West Virginia compiled by the writer from a large number of detailed sections given in other State Reports, was published on page 179 of the Doddridge-Harrison report of the State Survey. Most of the names of formations are taken from Pennsylvania places, since these rocks were first studied in that State, but later names added from West Virginia are Annabelle shale, Gilboy and Arnoldsburg sandstones, and Benwood limestone:



## General Section of the Monongahela Series for West Virginia.

|  | Thickness.<br>Feet. | Total.<br>Feet. |      |
|--|---------------------|-----------------|------|
| Coal, Waynesburg.....                        | 5                   | 5               |      |
| Shale .....                                  | 10                  | 15              |      |
| Sandstone, Gilboy.....                       | 35                  | 50              |      |
| Coal, Little Waynesburg.....                 | 1                   | 51              | 51'  |
| Limestone, Waynesburg.....                   | 4                   | 55              |      |
| Shale .....                                  | 13                  | 68              |      |
| Sandstone, Uniontown.....                    | 35                  | 103             |      |
| Shale, brown, Annabelle, 15' to.....         | 0                   | 103             |      |
| Coal, Uniontown.....                         | 2                   | 105             | 54'  |
| Shale .....                                  | 10                  | 115             |      |
| Limestone, Uniontown.....                    | 15                  | 130             |      |
| Shale, with thin sandstones and limestones.. | 44                  | 174             |      |
| Sandstone, Arnoldsburg.....                  | 30                  | 204             |      |
| Coal, Lower Uniontown.....                   | 1                   | 205             | 100' |
| Shale .....                                  | 5                   | 210             |      |
| Limestone, Benwood.....                      | 65                  | 275             |      |
| Sandstone, Sewickley.....                    | 25                  | 300             |      |
| Coal, Sewickley.....                         | 5                   | 305             | 100' |
| Sandstone, Lower Sewickley.....              | 25                  | 330             |      |
| Limestone Sewickley.....                     | 43                  | 373             |      |
| Coal, Redstone.....                          | 4                   | 377             | 72'  |
| Limestone, Redstone.....                     | 5                   | 382             |      |
| Sandstone Upper Pittsburgh.....              | 15                  | 397             |      |
| Shale, My.....                               | 5                   | 402             |      |
| Coal, Pittsburgh.....                        | 8                   | 410             | 33'  |

The Monongahela series has been elevated above drainage by the Wolf Summit, Mooresville, Indiana and Chestnut Ridge anticlines. The detailed crop of the measures is outlined on Map II. In Chapter IV several sections of the Monongahela rocks, either wholly or in part, have been given along with a table summarizing the same at the end of that chapter. The thickness is shown to vary from 350 feet in the St. Cloud section of western Monongalia to slightly over 400 feet in the Monongah region of southern Marion county. In addition to the above mentioned data, a large fund of information on the Monongahela rocks has been obtained from the logs of several diamond drill core test well borings, the most of which are located in Lincoln and Fairmont districts, Marion county. Several of these will now be given to preserve them from loss, since they give valuable data as to the thickness and character of the several coals of the series as well as the character of the material likely to be encountered in sinking shafts to the latter beds.

Morgan Fox Core Test No. 14 (621).

Located 0.5 mile north of Farmington. Authority, Consolidation Coal Company.

|   | Thickness. Total. |         |      |
|---|-------------------|---------|------|
|   | Ft. In.           | Ft. In. |      |
| (Elevation, 998.50 A. T.)               |                   |         |      |
| Surface .....                           | 3 0               | 3 0     |      |
| Sandy shale.....                        | 21 9              | 24 9    |      |
| Coal, Uniontown.....                    | 0 6               | 25 3    | 25.2 |
| Dark sandy shale.....                   | 2 10              | 28 1    |      |
| Sandstone .....                         | 6 10              | 34 11   |      |
| Dark slate.....                         | 4 0               | 38 11   |      |
| Limestone, Uniontown.....               | 4 2               | 43 1    |      |
| Shaly fire clay.....                    | 9 6               | 52 7    |      |
| Red shale.....                          | 1 6               | 54 1    |      |
| Fire clay and limestone.....            | 4 0               | 58 1    |      |
| Blue shale.....                         | 7 0               | 65 1    |      |
| Limestone .....                         | 8 0               | 73 1    |      |
| Blue shale.....                         | 30 0              | 103 1   |      |
| Bone .....                              | 0 3               | 103 4   |      |
| Limestone .....                         | 18 0              | 121 4   |      |
| Fire clay.....                          | 8 3               | 125 7   |      |
| Carbon slate.....                       | 1 3               | 130 10  |      |
| Limestone with streaks of fire clay,    |                   |         |      |
| Benwood .....                           | 41 0              | 171 10  |      |
| Fire clay.....                          | 8 0               | 179 10  |      |
| Dark shale.....                         | 7 8               | 187 6   |      |
| Sandstone .....                         | 3 6               | 191 0   |      |
| Dark slate.....                         | 7 0               | 198 0   |      |
| Sandstone .....                         | 1 0               | 199 0   |      |
| Dark slate.....                         | 10 2              | 209 2   |      |
| Coal, Sewickley (elev. at bottom.       |                   |         |      |
| 783.25') .....                          | 6 1               | 215 3   | 190' |
| Fire clay.....                          | 2 0               | 217 3   |      |
| Limestone .....                         | 6 0               | 223 3   |      |
| Gray shale.....                         | 25 7              | 248 10  |      |
| Limestone, Sewickley.....               | 21 0              | 269 10  |      |
| Fire clay.....                          | 3 2               | 273 0   |      |
| Black slate.....                        | 2 0               | 275 0   |      |
| Shaly fire clay.....                    | 9 0               | 284 0   |      |
| Fire clay.....                          | 4 0               | 288 0   |      |
| Light shale.....                        | 11 0              | 299 0   |      |
| Sandstone .....                         | 2 10              | 301 10  |      |
| Black slate.....                        | 20 0              | 321 10  |      |
| Sulphur coal...1' 3" )                  |                   |         |      |
| Slaty fire clay.1 0 ( 2' 3" )           |                   |         |      |
| Coal, top.....1' 6" )                   |                   |         |      |
| Coal, middle...5 8 } 8' 2" } Pittsburgh | 10 5              | 332 3   | 117  |
| Coal, bottom...1 0 }                    |                   |         |      |
| Elevation, bottom, 666.25' A. T.        |                   |         |      |

The composition of the Sewickley coal in this boring as reported by the Company is found on a subsequent page under the discussion of this seam.

The composition of the Pittsburgh coal in the same boring is reported by the Company as follows:

|                      | Top Coal.     | Middle Coal.  | Bottom Coal.  | Average.      |
|----------------------|---------------|---------------|---------------|---------------|
| Moisture .....       | 1.29          | 1.25          | 1.34          | 1.27          |
| Volatile Matter..... | 35.77         | 35.43         | 34.88         | 35.42         |
| Fixed Carbon.....    | 55.02         | 58.16         | 56.18         | 57.34         |
| Ash .....            | 7.92          | 5.16          | 7.60          | 5.97          |
| <b>Totals.....</b>   | <b>100.00</b> | <b>100.00</b> | <b>100.00</b> | <b>100.00</b> |
| Sulphur .....        | 1.18          | 0.89          | 2.98          | 1.20          |
| Phosphorus .....     | 0.084         | 0.004         | 0.019         | 0.020         |

The results show a very high grade low sulphur coal at this locality.

### Jessie B. Martin Core Test No. 10 (623).

Located 1.5 miles southwest of Farmington, Marion County. Authority, The Consolidation Coal Co.

(Elevation, 936.10' L-A. T.)

|  | Thickness. |          | Total.       |
|--|------------|----------|--------------|
|  | Ft.        | In.      |              |
| Surface .....  | 13         | 0        | 13 0         |
| Sandstone .....  | 2          | 9        | 15 9         |
| Light shale.....   | 3          | 3        | 19 0         |
| Limestone .....  | 16         | 6        | 35 6         |
| Fire clay.....   | 7          | 9        | 43 3         |
| <b>Coal, Lower Uniontown (elev., bottom, 891.35' A. T.).....</b> | <b>1</b>   | <b>6</b> | <b>44 9</b>  |
| Limestone .....  | 9          | 3        | 54 0         |
| Fire clay.....   | 3          | 6        | 57 6         |
| Limestone .....  | 9          | 6        | 67 0         |
| Green shale.....   | 3          | 0        | 70 0         |
| Limestone .....  | 15         | 8        | 85 8         |
| Shaly fire clay.....   | 13         | 0        | 98 8         |
| Black slate.....   | 9          | 0        | 107 8        |
| Sandstone .....  | 3          | 10       | 111 6        |
| Black slate.....   | 7          | 0        | 118 6        |
| <b>Coal, Sewickley (elev., bottom, 812.60' A. T.).....</b>       | <b>5</b>   | <b>0</b> | <b>123 6</b> |
| Fire clay.....   | 3          | 8        | 161 0        |
| Fire clay.....   | 2          | 10       | 126 4        |
| Limestone .....  | 4          | 9        | 131 1        |
| Slaty fire clay.....   | 16         | 0        | 147 1        |
| Sandstone .....  | 10         | 3        | 157 4        |
| Limestone .....  | 14         | 7        | 175 7        |
| Slaty fire clay.....   | 29         | 6        | 205 1        |
| Dark slate.....  | 15         | 5        | 220 6        |
| Sandstone .....  | 8          | 6        | 229 0        |
| Black slate.....   | 4          | 9        | 233 9        |

|                                |       | Thickness.    | Total. |       |        |
|--------------------------------|-------|---------------|--------|-------|--------|
|                                |       | Feet.         | Feet.  |       |        |
| Coal .....                     | 0' 9" | } Pittsburgh. | 10 0   | 243 9 | 120.2' |
| Slate and fire clay.           | 1 1   |               |        |       |        |
| Coal .....                     | 3 2   |               |        |       |        |
| Band .....                     | 0 0½  |               |        |       |        |
| Coal .....                     | 0 6   |               |        |       |        |
| Band .....                     | 0 0½  |               |        |       |        |
| Coal .....                     | 4 5   |               |        |       |        |
| (Elev., bottom, 692.35' A. T). |       |               |        |       |        |
| Fire clay.....                 |       |               |        |       |        |

The composition of the Lower Uniontown coal as reported by the Company is found on a subsequent page under the discussion of this coal.

**E. T. Wood Core Test Boring No. 3 (625).**

Located 1.3 miles southeast of Downs, Marlon County. Authority, Pittsburgh-Buffalo Company.  
(Elevation, 973.81' L-A. T.)

|   | Thickness. | Total.  |        |
|---|------------|---------|--------|
|   | Ft. In.    | Ft. In. |        |
| Surface .....                             | 7 0        | 7 0     |        |
| Sand rock.....                            | 3 0        | 10 0    |        |
| Sandy shale .....                         | 15 0       | 25 0    |        |
| Sand rock.....                            | 13 0       | 38 0    |        |
| Limestone .....                           | 3 0        | 41 0    |        |
| Sand rock.....                            | 12 0       | 53 0    |        |
| Light shale.....                          | 13 0       | 66 0    |        |
| Gray shale.....                           | 8 0        | 74 0    |        |
| Limestone .....                           | 7 0        | 81 0    |        |
| Gray shale.....                           | 1 6        | 82 6    |        |
| Limestone, shale streaks.....             | 60 6       | 143 0   |        |
| Green shale.....                          | 23 0       | 166 0   |        |
| Gray slate.....                           | 6 6        | 172 6   |        |
| Black slate.....                          | 2 0        | 174 6   |        |
| Coal, Sewickley.....                      | 5 3        | 179 9   | 179.7' |
| Fire clay.....                            | 2 10       | 182 7   |        |
| Limestone .....                           | 7 0        | 189 7   |        |
| Gray shale, lime streak.....              | 14 5       | 204 0   |        |
| Hard sand rock.....                       | 13 0       | 217 0   |        |
| Limestone .....                           | 12 0       | 229 0   |        |
| Gray shale.....                           | 18 0       | 247 0   |        |
| Black slate and fire clay.....            | 1 8        | 248 8   |        |
| Sandy shale.....                          | 26 4       | 275 0   |        |
| Gray slate.....                           | 13 1       | 288 1   |        |
| Coal, Pittsburgh (Bottom, 677.56' A. T.). | 8 2        | 296 3   | 116.5' |

According to determination made by Reger with hand-level, the boring starts 2½ feet below the Uniontown coal, and 110 feet below the top of the Waynesburg bed—4 feet thick—giving the total thickness of the Monongahela series here as 406' 3".

## Absalom Martin Core Test Boring (634A).

Located 1.2 miles north of Annabelle, Lincoln district, Marion County. Authority, Pittsburgh-Buffalo Company.

| (Elevation, 1122.07' L.-A. T.)                 |  | Thickness. | Total.  |        |
|--|--|------------|---------|--------|
|  |  | Ft. In.    | Ft. In. |        |
| <b>Dunkard Series (29')</b>                    |  |            |         |        |
| Surface .....                                  |  | 6 0        | 6 0     |        |
| Hard sandy shale.....                          |  | 23 0       | 29 0    | 29'    |
| <b>Monongahela Series (415')</b>               |  |            |         |        |
| Gray slate (coal seams).3' } <b>Waynesburg</b> |  |            |         |        |
| Coal .....3 } coal ...                         |  | 6 0        | 35 6    |        |
| Soapstone .....                                |  | 13 6       | 49 0    |        |
| Light rock.....                                |  | 31 0       | 80 0    |        |
| Dark gray shale.....                           |  | 11 0       | 91 0    |        |
| Light rock.....                                |  | 13 0       | 104 0   |        |
| Olive shale.....                               |  | 10 0       | 114 0   |        |
| Limestone, Uniontown.....                      |  | 12 0       | 126 0   |        |
| Dark gray shale.....                           |  | 6 0        | 132 0   |        |
| Fire clay.....                                 |  | 2 0        | 134 0   |        |
| Gray shale.....                                |  | 10 0       | 144 0   |        |
| Lime .....                                     |  | 10 0       | 154 0   |        |
| Gray slate.....                                |  | 4 0        | 158 0   |        |
| Gray slate.....                                |  | 4 0        | 162 0   |        |
| Sandy limestone.....                           |  | 22 0       | 184 0   |        |
| Limestone .....                                |  | 11 0       | 195 0   |        |
| Hard shale.....                                |  | 20 0       | 215 0   |        |
| Limestone .....                                |  | 4 0        | 219 0   |        |
| Olive shale.....                               |  | 2 0        | 221 0   |        |
| Limestone .....                                |  | 7 0        | 228 0   |        |
| Dark and gray shales.....                      |  | 3 0        | 231 0   |        |
| Limestone .....                                |  | 6 0        | 237 0   |        |
| Hard gray shales.....                          |  | 5 0        | 242 0   |        |
| Streaky limestone.....                         |  | 38 0       | 280 0   |        |
| Limestone .....                                |  | 12 0       | 292 0   |        |
| Light blue sandy shale.....                    |  | 8 0        | 300 0   |        |
| Limestone .....                                |  | 2 0        | 302 0   |        |
| Light blue shale.....                          |  | 4 0        | 306 0   |        |
| Limestone .....                                |  | 1 0        | 307 0   |        |
| Gray shale.....                                |  | 6 0        | 313 0   |        |
| Black slate.....                               |  | 2 0        | 315 0   |        |
| Coal, Sewickley.....                           |  | 5 2        | 320 2   | 291.2' |
| Fire clay.....                                 |  | 2 6        | 322 8   |        |
| Limestone .....                                |  | 2 8        | 325 4   |        |
| Shaly limestone.....                           |  | 4 0        | 329 4   |        |
| Sandy shales.....                              |  | 31 0       | 360 4   |        |
| Limestone .....                                |  | 16 0       | 376 4   |        |
| Sand rock.....                                 |  | 3 0        | 379 4   |        |
| Sandy shale.....                               |  | 7 0        | 386 4   |        |
| Limestone .....                                |  | 4 0        | 390 4   |        |
| Sandy slate.....                               |  | 7 0        | 397 4   |        |
| Gray shale.....                                |  | 10 0       | 407 4   |        |
| Light shale.....                               |  | 4 0        | 411 4   |        |
| Gray slate.....                                |  | 11 0       | 422 4   |        |
| Dark slate.....                                |  | 10 6       | 432 10  |        |
| Sandy limestone.....                           |  | 1 2        | 434 0   |        |
| Coal and slate.3' 0" } <b>Pittsburgh coal.</b> |  | 10 0       | 444 0   | 113.8' |
| (Bottom. 678.07'                               |  |            |         |        |
| Coal .....7 0 } <b>A. T.)</b>                  |  |            |         |        |
| Fire clay.....                                 |  |            |         |        |

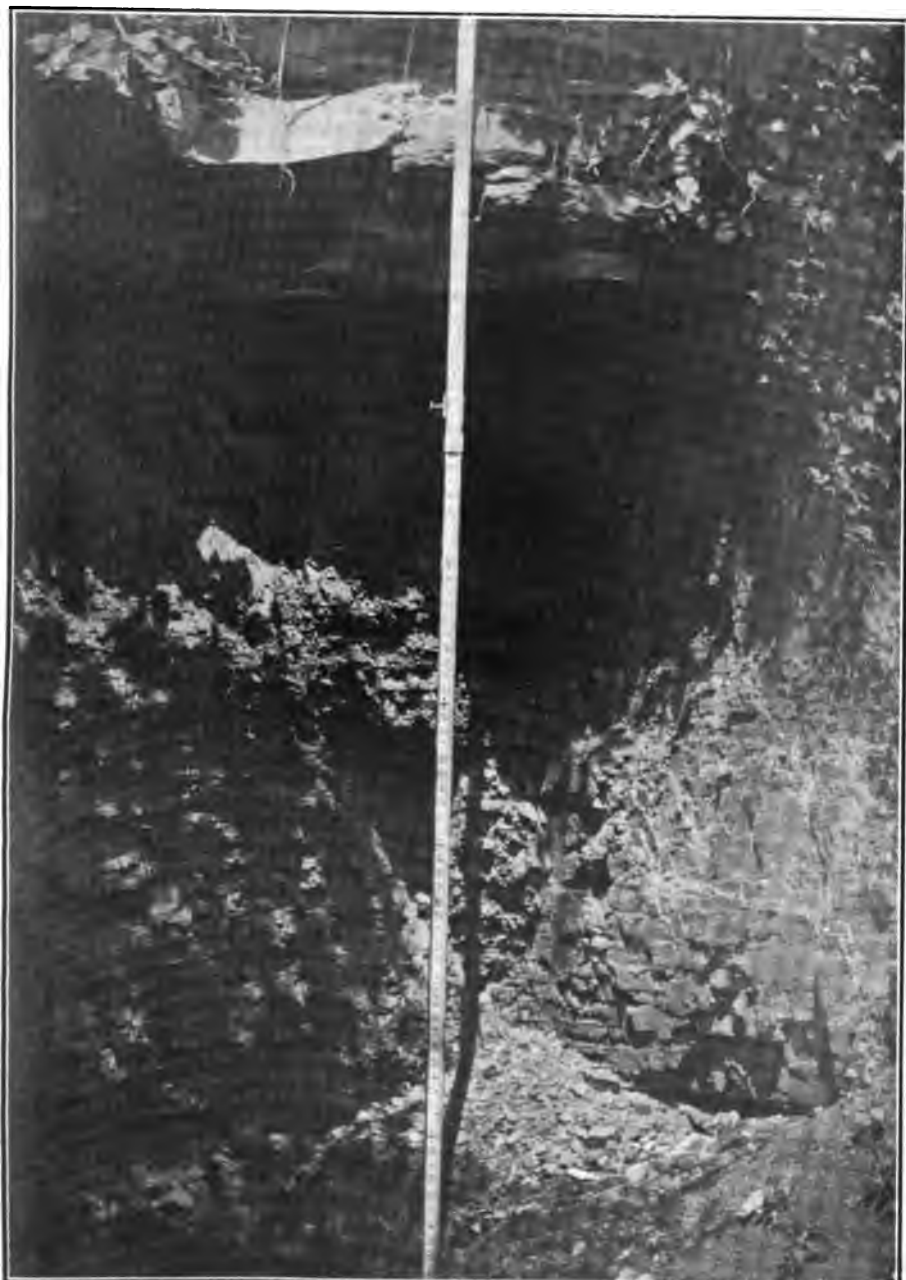
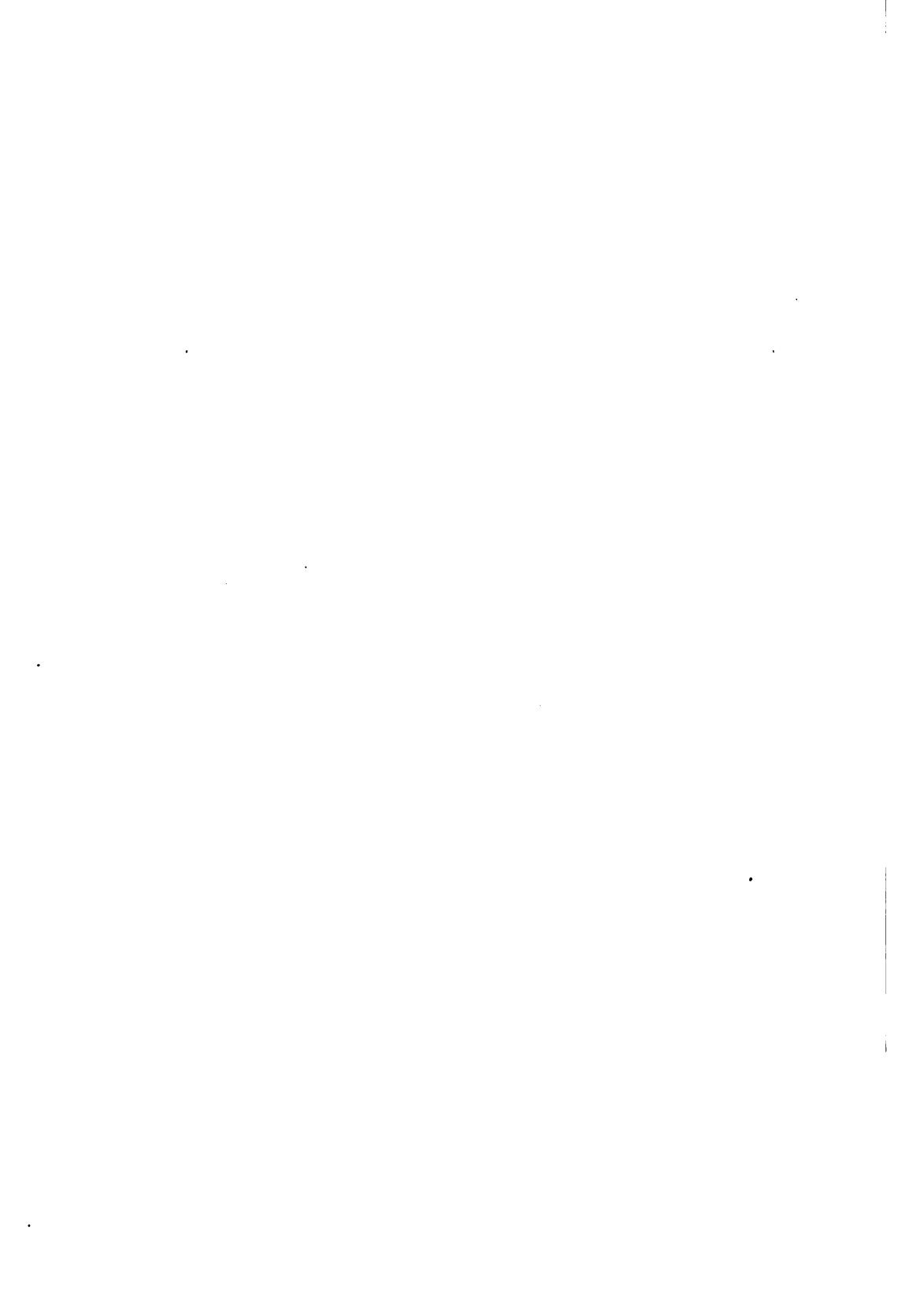


Photo by Ray Bricker.

**PLATE XVI.**—Sewickley Coal outcrop, Harvey Fisher farm, opposite  
Round Bottom, Monongalia County.



The accurate log of the **W. S. Parish No. 11 Core Test Boring**, (628), located one mile north of Festus, Lincoln district, Marion county, has been published in full on pages 676-679 of Vol. II(A) and pages 175-176 of the Wirt-Roane-Calhoun report of the State Survey. This is an important record in that it gives the true position of the Lower Union-town coal where the latter was first named.

The composition of the Sewickley coal in the latter boring, as reported by the company is given on a subsequent page under the discussion of this bed.

### Olive Minnear No. 2 Core Test (639 A).

Located 0.8 miles northwest of Festus. Authority, Pittsburgh-Buffalo Company.

|                              | Thickness. |     | Total.  |
|------------------------------|------------|-----|---------|
|                              | Ft.        | In. | Ft. In. |
| Surface .....                | 4          | 0   | 4 0     |
| Gray shale.....              | 10         | 0   | 14 0    |
| Sandy limestone.....         | 4          | 0   | 18 0    |
| Red shale.....               | 5          | 0   | 23 0    |
| Hard gray shale.....         | 18         | 0   | 41 0    |
| Fire clay.....               | 2          | 0   | 43 0    |
| Hard gray shale.....         | 7          | 0   | 50 0    |
| Limestone .....              | 3          | 6   | 53 6    |
| Fire clay.....               | 1          | 6   | 55 0    |
| Limestone .....              | 6          | 0   | 61 0    |
| Hard gray shale.....         | 4          | 0   | 65 0    |
| Soft gray and red shale..... | 4          | 6   | 69 6    |
| Fire clay.....               | 5          | 6   | 75 0    |
| Limestone .....              | 5          | 0   | 80 0    |
| Hard gray shale.....         | 4          | 0   | 84 0    |
| Limestone .....              | 2          | 0   | 86 0    |
| Light shale.....             | 3          | 0   | 89 0    |
| Limestone .....              | 9          | 0   | 98 0    |
| Hard shale.....              | 2          | 0   | 100 0   |
| Limestone .....              | 3          | 0   | 103 0   |
| Dark shale.....              | 3          | 0   | 106 0   |
| Limestone .....              | 5          | 0   | 111 0   |
| Gray shale.....              | 1          | 0   | 112 0   |
| Limestone .....              | 7          | 0   | 119 0   |
| Gray shale.....              | 1          | 0   | 120 0   |
| Limestone .....              | 9          | 0   | 129 0   |
| Hard sandy shale.....        | 4          | 0   | 133 0   |
| Sand rock.....               | 1          | 0   | 134 0   |
| Soft gray shale.....         | 2          | 6   | 136 6   |
| Slate .....                  | 2          | 0   | 138 6   |
| Coal. Sewickley.....         | 6          | 1   | 144 7   |
| Hard sandy shale.....        | 27         | 5   | 172 0   |
| Sand rock.....               | 2          | 0   | 174 0   |
| Hard gray shale.....         | 5          | 0   | 179 0   |

144.6'



|  | Thickness. Total. |        |        |
|--|-------------------|--------|--------|
|  | Feet.             | Feet.  |        |
| Soft gray shale.....                               | 9 0               | 188 0  |        |
| Limestone, Sewickley.....                          | 12 0              | 200 0  |        |
| Sandy shale.....                                   | 19 0              | 219 0  |        |
| Limestone.....                                     | 2 0               | 221 0  |        |
| Gray shale.....                                    | 6 0               | 227 0  |        |
| Sandy shale.....                                   | 8 0               | 235 0  |        |
| Soft gray shale.....                               | 10 6              | 245 6  |        |
| Sandy shale.....                                   | 4 9               | 250 3  |        |
| Dark slate.....                                    | 6 0               | 256 3  |        |
| Gray sandy shale.....                              | 4 9               | 261 0  |        |
| Dark slate.....                                    | 6 10              | 267 10 |        |
| Coal, Pittsburgh (Bottom, 731.96'<br>L-A. T.)..... | 7 0               | 274 10 | 130.2' |
| Fire clay.....                                     |                   |        |        |

### Jane Downs Core Test No. 4 (640A).

Located 0.4 mile northwest of Annabelle, Marlon County. Authority, Pittsburgh-Buffalo Company.

(Elevation, 1064.11' L-A. T.)

|                                       | Thickness. |       | Total. |
|---------------------------------------|------------|-------|--------|
|                                       | Ft.        | In.   |        |
| Surface.....                          | 10 0       | 10 0  |        |
| Gray shale.....                       | 5 0        | 15 0  |        |
| Sand rock.....                        | 4 0        | 19 0  |        |
| Gray sandy shale.....                 | 12 0       | 31 0  |        |
| Dark sandy shale.....                 | 4 0        | 35 0  |        |
| Fire clay.....                        | 1 6        | 36 6  |        |
| Dark shale.....                       | 3 8        | 40 2  |        |
| Black slate and coal, (Uniontown).... | 1 0        | 41 2  | 41.2'  |
| Sand rock.....                        | 2 10       | 44 0  |        |
| Dark shale.....                       | 10 0       | 54 0  |        |
| Gray shale.....                       | 7 0        | 61 0  |        |
| Sandy shale.....                      | 2 0        | 63 0  |        |
| Fire clay.....                        | 3 0        | 66 0  |        |
| Sandy shales.....                     | 3 0        | 69 0  |        |
| Sand rock and shales.....             | 14 0       | 83 0  |        |
| Limestone.....                        | 2 0        | 85 0  |        |
| Gray sandy shales.....                | 5 0        | 90 0  |        |
| Soft sandy shales.....                | 4 0        | 94 0  |        |
| Gray sandy shales.....                | 19 0       | 113 0 |        |
| Limestone.....                        | 2 0        | 115 0 |        |
| Gray shale.....                       | 3 0        | 118 0 |        |
| Limestone.....                        | 4 0        | 122 0 |        |
| Gray shale.....                       | 5 0        | 127 0 |        |
| Limestone.....                        | 7 0        | 134 0 |        |
| Soft gray shale.....                  | 3 0        | 137 0 |        |
| Limestone.....                        | 2 0        | 139 0 |        |
| Soft gray shale.....                  | 2 0        | 141 0 |        |
| Limestone.....                        | 1 0        | 142 0 |        |
| Fire clay.....                        | 1 0        | 143 0 |        |
| Limestone.....                        | 8 0        | 151 0 |        |
| Gray shale.....                       | 2 0        | 153 0 |        |
| Limestone.....                        | 3 0        | 156 0 |        |
| Sandy shale.....                      | 2 0        | 158 0 |        |
| Limestone.....                        | 10 0       | 168 0 |        |

|                                    | Thickness. |     | Total. |    |
|------------------------------------|------------|-----|--------|----|
|                                    | Feet.      | In. |        |    |
| Gray shale.....                    | 1          | 0   | 169    | 0  |
| Limestone.....                     | 26         | 0   | 195    | 0  |
| Green shale—hard bands.....        | 10         | 0   | 205    | 0  |
| Slate and bone.....                | 1          | 10  | 206    | 10 |
| Coal, Sewickley.....               | 6          | 2   | 213    | 0  |
| Green and gray sandy shale.....    | 14         | 0   | 227    | 0  |
| Sand rock—hard bands.....          | 21         | 0   | 248    | 0  |
| Limestone.....                     | 3          | 0   | 251    | 0  |
| Gray shale.....                    | 4          | 0   | 255    | 0  |
| Limestone.....                     | 15         | 0   | 270    | 0  |
| Gray shale—lime streaks.....       | 16         | 0   | 286    | 0  |
| Limestone.....                     | 5          | 0   | 291    | 0  |
| Light shale and black slate.....   | 1          | 10  | 292    | 10 |
| Shaly limestone.....               | 17         | 10  | 310    | 8  |
| Gray, black and sandy slate.....   | 16         | 3   | 326    | 11 |
| Coal.....0' 4" } Pittsburgh        |            |     |        |    |
| Top slate.....1 9 } coal.....      | 9          | 11  | 336    | 10 |
| Coal.....7 10 }                    |            |     |        |    |
| Bottom of Pittsburgh coal, 727.28' |            |     |        |    |
| L.A. T.....                        |            |     |        |    |

171.8'

123.8'

Mary Hawkins Core Test No. 13 (643).

Located 0.6 mile southeast of Sturms Mill, Marion County. Authority, Consolidation Coal Company.  
(Elevation, 946.06' L-A. T.)

|   | Thickness. |     | Total. |     |
|---|------------|-----|--------|-----|
|   | Ft.        | In. |        | Ft. |
| Surface.....  | 6          | 6   | 6      | 6   |
| Limestone.....  | 9          | 0   | 15     | 6   |
| Sandstone.....  | 3          | 6   | 19     | 0   |
| Soft shale.....   | 8          | 0   | 27     | 0   |
| Slaty fire clay.....  | 10         | 0   | 37     | 0   |
| Limestone.....  | 5          | 6   | 42     | 6   |
| Fire clay.....  | 0          | 7   | 43     | 1   |
| Coal and slate, Redstone, (Elev., bottom, 902.73' L-A. T.)..... | 0          | 3   | 43     | 4   |
| Dark shale.....   | 2          | 4   | 45     | 8   |
| Limestone.....  | 15         | 4   | 61     | 0   |
| Fire clay.....  | 4          | 6   | 65     | 6   |
| Coal.....0' 6" } Pittsburgh....                                 |            |     |        |     |
| Slate.....1 6 } (Elevation,                                     |            |     |        |     |
| Coal.....2 0 } bottom, 871.60'                                  | 8          | 11½ | 74     | 5½  |
| Binder.....0 0½ } L-A. T.)                                      |            |     |        |     |
| Coal.....0 6½ }   |            |     |        |     |
| Binder.....0 0½ }   |            |     |        |     |
| Coal.....2 3 }  |            |     |        |     |
| Binder.....0 0½ }   |            |     |        |     |
| Coal.....2 0½ }   |            |     |        |     |
| Fire clay.....  |            |     |        |     |

## Z. F. Davis Core Test No. 4 (646).

Located at junction of Martins and Helens runs. Authority, Consolidation Coal Company.

(Elevation, 964.65' L-A. T.)

|                     | Thickness.       |     | Total. |    |
|---------------------|------------------|-----|--------|----|
|                     | Ft.              | In. |        |    |
| Surface .....       | 5                | 10  | 5      | 10 |
| Limestone .....     | 7                | 8   | 13     | 6  |
| Fire clay.....      | 4                | 6   | 18     | 0  |
| Limestone .....     | 8                | 6   | 26     | 6  |
| Green shale.....    | 5                | 3   | 31     | 9  |
| Limestone .....     | 21               | 0   | 52     | 9  |
| Light shale.....    | 10               | 0   | 62     | 9  |
| Sandstone .....     | 3                | 7   | 66     | 4  |
| Black slate.....    | 2                | 2   | 68     | 6  |
| Coal .....1' 8"     | } Sewickley ...  | 6   | 74     | 6  |
| Slate .....0 0½     |                  |     |        |    |
| Coal .....0 6       |                  |     |        |    |
| Slate .....0 1      |                  |     |        |    |
| Coal .....3 5       |                  |     |        |    |
| Bony coal.....0 3½  |                  |     |        |    |
| Fire clay.....      | 14               | 0   | 88     | 6  |
| Gray shale.....     | 16               | 7   | 105    | 1  |
| Black slate.....    | 0                | 2   | 105    | 3  |
| Fire clay.....      | 1                | 1   | 106    | 4  |
| Sandy shale.....    | 8                | 6   | 114    | 10 |
| Fire clay.....      | 4                | 4   | 119    | 2  |
| Limestone .....     | 11               | 6   | 130    | 8  |
| Green shale.....    | 14               | 10  | 145    | 6  |
| Limestone .....     | 9                | 0   | 154    | 6  |
| Fire clay.....      | 18               | 2   | 172    | 8  |
| Light shale.....    | 12               | 0   | 184    | 8  |
| Dark slate.....     | 7                | 5   | 192    | 1  |
| Sandstone .....     | 3                | 2   | 195    | 3  |
| Black slate.....    | 2                | 8   | 197    | 11 |
| Coal .....0' 5"     | } Pittsburgh.... | 9   | 207    | 4  |
| Fire clay.....1 0   |                  |     |        |    |
| Black slate.....0 4 |                  |     |        |    |
| Coal .....2 5½      |                  |     |        |    |
| Bone .....0 0½      |                  |     |        |    |
| Coal .....0 6       |                  |     |        |    |
| Bone .....0 0½      |                  |     |        |    |
| Coal .....4 7½      |                  |     |        |    |
| Fire clay.....      |                  |     |        |    |

According to Mr. Reger, the Lower Uniontown coal—6 inches thick—crops flush with the top of the boring.

The composition of the Sewickley coal, as reported by the company, is found on a subsequent page under the discussion of this coal.

W. P. Fortney Core Test No. 3 (647).

Located on Tevebaugh creek, Marion county, 1 mile northwest of Worthington. Authority, Consolidation Coal Company.  
(Elevation, 917.65' L-A. T.)

|                                      | Thickness. |     | Total. |        |
|--------------------------------------|------------|-----|--------|--------|
|                                      | Ft.        | In. | Ft.    | In.    |
| Surface .....                        | 5          | 0   | 5      | 0      |
| Limestone .....                      | 25         | 8   | 30     | 8      |
| Green shale.....                     | 3          | 0   | 33     | 8      |
| Light shale.....                     | 10         | 5   | 44     | 1      |
| Slate .....                          | 3          | 4   | 47     | 5      |
| Coal .....1' 4" } Sewickley .....    | 5          | 11  | 53     | 4      |
| Slate .....1 3 } (Elevation, bottom, |            |     |        |        |
| Coal .....3 4 } 864.3' L-A. T.)      |            |     |        | 53.3'  |
| Fire clay.....                       | 8          | 6   | 61     | 10     |
| Sandy shale.....                     | 3          | 3   | 65     | 1      |
| Sandstone .....                      | 3          | 5   | 68     | 6      |
| Sandy shale.....                     | 34         | 6   | 103    | 0      |
| Limestone .....                      | 11         | 8   | 114    | 8      |
| Fire clay.....                       | 5          | 6   | 120    | 2      |
| Sandstone .....                      | 3          | 8   | 123    | 10     |
| Gray shale.....                      | 7          | 7   | 131    | 5      |
| Limestone .....                      | 4          | 0   | 135    | 5      |
| Light shale.....                     | 23         | 2   | 158    | 7      |
| Gray shale.....                      | 2          | 0   | 160    | 7      |
| Sandstone .....                      | 3          | 8   | 164    | 3      |
| Gray shale.....                      | 10         | 4   | 174    | 7      |
| Black slate.....                     | 8          | 1   | 182    | 8      |
| Coal .....0' 7½" }                   |            |     |        |        |
| Slate .....0 6 }                     |            |     |        |        |
| Coal .....2 7 }                      |            |     |        |        |
| Bone ....0 0¾ } Pittsburgh .....     | 9          | 1½  | 191    | 9½     |
| Coal .....0 6¼ } (Elevation, bottom, |            |     |        | 138.5' |
| Bone .....0 1 } 725.86' L-A. T.)     |            |     |        |        |
| Coal .....0 2½ }                     |            |     |        |        |
| Bone .....0 0¾ }                     |            |     |        |        |
| Coal .....4 6¼ }                     |            |     |        |        |
| Fire clay.....                       |            |     |        |        |

The composition of the Sewickley coal in this boring as reported by the company, is found on a subsequent page under the discussion of this coal.

Nancy Billingsley Core Test No. 5 (652).

Located on Camp run, 0.5 mile northwest of Hutchinson. Authority, Consolidation Coal Company.  
(Elevation, 993.85')

|                          | Thickness. |     | Total. |     |
|--------------------------|------------|-----|--------|-----|
|                          | Ft.        | In. | Ft.    | In. |
| Surface .....            | 12         | 0   | 12     | 0   |
| Limestone .....          | 1          | 0   | 13     | 0   |
| Fire clay.....           | 3          | 0   | 16     | 0   |
| Limestone and shale..... | 57         | 6   | 73     | 6   |
| Fire clay.....           | 6          | 3   | 79     | 9   |

|   | Thickness. |    | Total.    |    |       |  |
|---|------------|----|-----------|----|-------|--|
|   | Feet. In.  |    | Feet. In. |    |       |  |
| Coal, Sewickley, (elevation, bottom, 913.77' L-A. T.).....  | 0          | 4  | 80        | 1  | 80.1' |  |
| Fire clay.....  | 2          | 9  | 82        | 10 |       |  |
| Limestone.....  | 1          | 0  | 83        | 10 |       |  |
| Fire clay.....  | 9          | 2  | 93        | 0  |       |  |
| Sandy shale.....  | 10         | 4  | 103       | 4  |       |  |
| Fire clay.....  | 3          | 10 | 107       | 2  |       |  |
| Sandy shale.....  | 13         | 3  | 120       | 5  |       |  |
| Fire clay.....  | 5          | 3  | 125       | 8  |       |  |
| Limestone.....  | 11         | 10 | 137       | 6  |       |  |
| Green shale.....  | 4          | 0  | 141       | 6  |       |  |
| Sandstone.....  | 2          | 5  | 143       | 11 |       |  |
| Light shale.....  | 6          | 10 | 150       | 9  |       |  |
| Limestone.....  | 5          | 0  | 155       | 9  |       |  |
| Fire clay.....  | 2          | 4  | 158       | 1  |       |  |
| Light shale.....  | 1          | 7  | 159       | 8  |       |  |
| Limestone.....  | 6          | 0  | 165       | 8  |       |  |
| Fire clay.....  | 8          | 2  | 173       | 10 |       |  |
| Sandy shale.....  | 6          | 10 | 180       | 8  |       |  |
| Sandstone.....  | 2          | 0  | 182       | 8  |       |  |
| Slate and sandstone.....  | 13         | 1  | 195       | 9  |       |  |
| Black slate.....  | 1          | 5  | 197       | 2  |       |  |
| Coal ....1' 2" }<br>Slate ....0 10 }<br>Coal ....2 11 } Pittsburgh<br>Bone ....0 0½ } (Elevation, bottom,<br>Coal ....0 6½ } 786.85' L-A. T.).. 9 10 207 0 126.9'<br>Bone ....0 2 }<br>Coal ....4 2 }<br>Fire clay..... |            |    |           |    |       |  |

The composition of the Sewickley coal in this boring as reported by the company is found on a subsequent page under the discussion of this coal.

### Wm. F. Sandy Core Test No. 12 (653).

Located on Sandys run, Marion County, 0.5 mile west of Hutchinson. Authority, Consolidation Coal Company.

|                            | Thickness. |    | Total.  |    |       |
|----------------------------|------------|----|---------|----|-------|
|                            | Ft. In.    |    | Ft. In. |    |       |
| Surface.....               | 20         | 0  | 20      | 0  | 83.2' |
| Green shale.....           | 2          | 5  | 22      | 5  |       |
| Limestone.....             | 12         | 5  | 34      | 10 |       |
| Light shale.....           | 21         | 2  | 56      | 0  |       |
| Limestone.....             | 12         | 6  | 68      | 6  |       |
| Gray shale.....            | 7          | 2  | 75      | 8  |       |
| Limestone.....             | 2          | 7  | 78      | 3  |       |
| Slaty fire clay.....       | 3          | 5  | 81      | 8  |       |
| Coal, Lower Uniontown..... | 1          | 6  | 83      | 2  |       |
| Limestone.....             | 25         | 8  | 108     | 10 |       |
| Green shale.....           | 1          | 0  | 109     | 10 |       |
| Limestone.....             | 42         | 3  | 152     | 1  |       |
| Green shale and lime.....  | 2          | 10 | 154     | 11 |       |

|                                       | Thickness.<br>Feet. In. | Total.<br>Feet. In. |       |
|---------------------------------------|-------------------------|---------------------|-------|
| Coal .....0' 2" } Sewickley           |                         |                     |       |
| Limestone...0 7 } (Elevation, bottom, | 2 2                     | 157 1               | 73.9' |
| Coal .....1 5 } 943.74' L-A. T.)      |                         |                     |       |
| Limestone .....                       | 1 0                     | 158 1               |       |
| Fire clay.....                        | 3 4                     | 161 5               |       |
| Limestone .....                       | 1 0                     | 162 5               |       |
| Shaly fire clay.....                  | 3 8                     | 166 1               |       |
| Sandstone .....                       | 7 7                     | 173 8               |       |
| Sandy shale.....                      | 3 7                     | 177 3               |       |
| Fire clay.....                        | 2 4                     | 179 7               |       |
| Light shale.....                      | 2 9                     | 182 4               |       |
| Sandstone .....                       | 13 4                    | 195 8               |       |
| Dark slate.....                       | 6 6                     | 202 2               |       |
| Limestone .....                       | 13 3                    | 215 5               |       |
| Dark slate.....                       | 14 0                    | 229 5               |       |
| Limestone .....                       | 3 3                     | 232 8               |       |
| Fire clay.....                        | 2 4                     | 235 0               |       |
| Coal, Redstone.....                   | 0 2                     | 235 2               | 78.1' |
| Fire clay.....                        | 31 8                    | 266 10              |       |
| Black slate.....                      | 4 11                    | 271 9               |       |
| Coal .....0' 8" } Pittsburgh .....    | 10 6                    | 282 3               | 47'   |
| Slate ....2 3 } (Elevation, bottom,   |                         |                     |       |
| Coal .....2 3 } 818.57' L-A. T.)      |                         |                     |       |
| Binder ...0 1                         |                         |                     |       |
| Coal .....0 6                         |                         |                     |       |
| Binder ...0 0½                        |                         |                     |       |
| Coal .....0 4                         |                         |                     |       |
| Binder ...0 0½                        |                         |                     |       |
| Coal .....4 4                         |                         |                     |       |
| Fire clay.....                        |                         |                     |       |

**Curtis Fletcher Core Test No. 9 (655).**

Located on Buffalo Creek, Marlon County, 1 mile east of Farmington. Authority, Consolidation Coal Company.

|  | Thickness.<br>Ft. In. | Total<br>Ft. In. |       |
|--|-----------------------|------------------|-------|
| (Elevation, 917.63' L-A. T.)           |                       |                  |       |
| Surface .....                          | 10 5                  | 10 5             |       |
| Limestone .....                        | 21 6                  | 31 11            |       |
| Light shale.....                       | 2 5                   | 34 4             |       |
| Limestone .....                        | 8 0                   | 42 4             |       |
| Sandstone .....                        | 7 0                   | 49 4             |       |
| Dark sandy shale.....                  | 19 8                  | 69 0             |       |
| Dark shale.....                        | 5 11                  | 74 11            |       |
| Sandstone .....                        | 1 0                   | 75 11            |       |
| Dark slate.....                        | 5 8                   | 81 7             |       |
| Coal .....1' 0" } Sewickley            |                       |                  |       |
| Slate binder.0 1 } (Elevation, bottom, |                       |                  |       |
| Coal .....1 5 } 830.38' L-A. T.)..     | 5 8                   | 87 3             | 87.2' |
| Slate binder.0 1                       |                       |                  |       |
| Coal .....2 2                          |                       |                  |       |
| Slate binder.0 3                       |                       |                  |       |
| Coal .....0 8                          |                       |                  |       |
| Fire clay.....                         | 2 10                  | 90 1             |       |
| Limestone .....                        | 2 6                   | 92 7             |       |

|  | Thickness. |     | Total. |       |
|--|------------|-----|--------|-------|
|  | Ft.        | In. | Ft.    | In.   |
| Slaty fire clay.....   | 16         | 0   | 108    | 7     |
| Sandstone .....  | 13         | 3   | 121    | 10    |
| Redstone? coal and slate (Lower Sewickley) .....   | 0          | 2   | 122    | 0     |
| Dark slate.....  | 0          | 3   | 122    | 3     |
| Shaly fire clay.....   | 6          | 0   | 128    | 3     |
| Limestone, Sewickley.....  | 15         | 8   | 143    | 11    |
| Fire clay.....   | 31         | 0   | 174    | 11    |
| Sandy shale.....   | 10         | 2   | 185    | 1     |
| Black slate.....   | 13         | 0   | 198    | 1     |
| Coal ....1' 0" }<br>Slate ...0 5 }<br>Coal ...2 11 }<br>Binder ..0 0½ } <b>Pittsburgh</b><br>Coal ....0 2½ } (Elevation, bottom,<br>Binder ..0 0½ } 710.05' L-A. T.).. 9 6 |            |     | 207    | 7     |
| Coal ....0 4 }<br>Binder ..0 0½ }<br>Coal ....4 6 }  |            |     |        | 85.6' |
| Fire clay.....   |            |     |        |       |

The composition of the Sewickley coal in this boring as reported by the company is found on a subsequent page under the discussion of this coal.

The log of the **Nancy Martin Core Test Well No. 6 (659)** of the Consolidation Coal Company, located on Mill Fall run, Marion county, a mile and a half north of Monongah, is published in connection with the section for Monongah, N. W., page 137. The composition of the Sewickley coal in this boring as reported by the company is found on a subsequent page under the discussion of this coal.

#### Morgan-Billingslee Core Test No. 8 (669).

Located on Buffalo creek, Marion County, 1.8 miles west of Bar-rackville. Authority, Consolidation Coal Company.  
(Elevation, 914.17' L-A. T.)

|                              | Thickness. |     | Total. |     |
|------------------------------|------------|-----|--------|-----|
|                              | Ft.        | In. | Ft.    | In. |
| Surface .....                | 5          | 2   | 5      | 2   |
| Limestone .....              | 53         | 0   | 58     | 2   |
| Shale with lime streaks..... | 14         | 6   | 72     | 8   |
| Black shale.....             | 6          | 0   | 78     | 8   |
| Sandstone .....              | 3          | 2   | 81     | 10  |
| Black slate.....             | 7          | 8   | 89     | 6   |

|                            | Thickness. | Total.    |                   |       |
|----------------------------|------------|-----------|-------------------|-------|
|                            | Feet. In.  | Feet. In. |                   |       |
| Coal .....                 | 1' 10"     |           | } Sewickley ..    | 9 5   |
| Slate, binder..            | 0 0½       |           |                   |       |
| Coal .....                 | 3 0½       |           |                   |       |
| Binder .....               | 0 1        |           |                   |       |
| Coal .....                 | 0 3        |           |                   |       |
| Fire clay.....             | 3 5        |           |                   |       |
| Coal .....                 | 0 1        |           |                   |       |
| Slate .....                | 0 4        |           |                   |       |
| Coal .....                 | 0 4        |           |                   |       |
| Fire clay.....             | 2 3        | 101 2     |                   |       |
| Limestone .....            | 1 2        | 102 4     |                   |       |
| Fire clay.....             | 7 6        | 109 10    |                   |       |
| Sandstone .....            | 8 5        | 118 3     |                   |       |
| Sandy shale.....           | 12 0       | 130 3     |                   |       |
| Fire clay.....             | 3 4        | 133 7     |                   |       |
| Limestone .....            | 1 7        | 135 2     |                   |       |
| Gray shale.....            | 5 4        | 140 6     |                   |       |
| Limestone .....            | 23 6       | 164 0     |                   |       |
| Fire clay.....             | 4 0        | 168 0     |                   |       |
| Black slate (fossil).....  | 5 6        | 173 6     |                   |       |
| Shale mixed with lime..... | 6 6        | 180 0     |                   |       |
| Fire clay.....             | 6 5        | 186 5     |                   |       |
| Slaty fire clay.....       | 8 0        | 194 5     |                   |       |
| Dark slate.....            | 5 8        | 200 1     |                   |       |
| Sandy shale.....           | 3 6        | 203 7     |                   |       |
| Sandstone .....            | 3 4        | 206 11    |                   |       |
| Black slate.....           | 11 2       | 218 1     |                   |       |
| Coal .....                 | 0' 8"      |           | } Pittsburgh .... | 9 11¼ |
| Black slate..              | 0 10½      |           |                   |       |
| Coal .....                 | 2 7½       |           |                   |       |
| Binder .....               | 0 0½       |           |                   |       |
| Coal .....                 | 0 8        |           |                   |       |
| Binder .....               | 0 0½       |           |                   |       |
| Coal .....                 | 5 0        |           |                   |       |
| Fire clay.....             |            |           |                   |       |

(Elevation, bottom,  
686.17' L-A. T.)

The composition of the Sewickley coal in this boring, as reported by the company, is found on a subsequent page under the discussion of this seam.

The two following sections of the Monongahela measures were kindly furnished the Survey from the logs of two shafts by the Jamison Coal & Coke Company at its Mine No. 7 at Barrackville, Marion county. Although the shafts are only a short distance apart, yet the records show quite a variation in the formations therein:

**Section of Hoisting Shaft No. 1, Mine No. 7, at Barrackville.**

|              | Thickness. | Total.  |
|--------------|------------|---------|
|              | Ft. In.    | Ft. In. |
| Coping ..... | 1 11       | 1 11    |
| Clay .....   | 7 7        | 9 6     |



|   | Thickness.<br>Feet. In. | Total.<br>Feet. In. |        |
|---|-------------------------|---------------------|--------|
| Shale .....   | 4 0                     | 13 6                |        |
| Limestone, Uniontown.. ..   | 0 11                    | 14 5                |        |
| Fire clay.....  | 7 8                     | 22 1                |        |
| Sandstone .....   | 1 10                    | 23 11               |        |
| Fire clay or gray shale (Sept. 1, 1909)..   | 4 0                     | 27 11               |        |
| Fire clay or gray shale.....  | 48 11                   | 76 10               |        |
| Limestone (Oct. 1, 1909).....   | 13 1                    | 89 11               |        |
| Limestone .....   | 16 10                   | 106 9               |        |
| Gray shale.....   | 3 0                     | 109 9               |        |
| Limestone .....   | 9 0                     | 118 9               |        |
| Gray shale.....   | 4 10                    | 123 7               |        |
| Limestone .....   | 11 2                    | 134 9               |        |
| Limestone .....   | 3 2                     | 137 11              |        |
| Gray shale.....   | 11 11                   | 149 10              |        |
| Slate .....   | 9 6                     | 159 4               |        |
| Coal .....3' 6" } Sewickley...  |                         |                     |        |
| Slate .....0 6 }  | 6 7                     | 165 11              | 165.9' |
| Bone coal.....2 7 }   |                         |                     |        |
| Slate .....   | 2 0                     | 167 11              |        |
| Fire clay.....  | 2 10                    | 170 9               |        |
| Limestone .....   | 1 7                     | 172 4               |        |
| Gray shale, (Nov. 1, 1909).....   | 7 7                     | 179 11              |        |
| Gray shale.....   | 4 3                     | 184 2               |        |
| Sandstone .....   | 8 8                     | 192 10              |        |
| Limestone and gray shale, mixed.....  | 14 10                   | 207 8               |        |
| Gray shale.....   | 4 6                     | 212 2               |        |
| Limestone .....   | 1 2                     | 213 4               |        |
| Gray shale.....   | 3 3                     | 216 7               |        |
| Limestone, mixed.....   | 3 10                    | 220 5               |        |
| Slate .....   | 1 0                     | 221 5               |        |
| Limestone .....   | 12 11                   | 234 4               |        |
| Gray shale.....   | 2 2                     | 236 6               |        |
| Limestone .....   | 10 6                    | 247 0               |        |
| Shale, hard sand.....   | 12 8                    | 259 8               |        |
| Shale, gray.....  | 4 7                     | 264 3               |        |
| Sandstone<br>(Dec. 1, 1909).... 5' 8" } Upper<br>Sandstone .....10 7 } Pittsburgh<br>Sandstone and slate, } sandstone.<br>mixed ..... 5 8 } 27 1 291 4<br>Sandstone ..... 5 2 } |                         |                     |        |
| Slate .....   | 1 10                    | 293 2               |        |
| Coal, Pittsburgh (Bottom elevation,<br>664.6' L.A. T.).....   | 9 1                     | 302 3               | 136.3' |

## Section of "B" Shaft, Plant No. 7, Barrackville.

| (Elevation, 960.6' L.A. T.) | Thickness<br>Ft. In. | Total.<br>Ft. In. |
|-----------------------------|----------------------|-------------------|
| Clay .....                  | 3 7                  | 3 7               |
| Shale .....                 | 4 6                  | 8 1               |
| Fire clay.....              | 2 0                  | 10 1              |
| Limestone .....             | 1 0                  | 11 1              |
| Fire clay.....              | 3 0                  | 14 1              |

|                                      | Thickness. |     | Total.    |    |        |
|--------------------------------------|------------|-----|-----------|----|--------|
|                                      | Feet.      | In. | Feet. In. |    |        |
| Shale, sandy.....                    | 3          | 10  | 17        | 11 |        |
| Fire clay.....                       | 52         | 2   | 70        | 1  |        |
| Limestone .....                      | 25         | 0   | 95        | 1  |        |
| Shale, gray.....                     | 3          | 0   | 98        | 1  |        |
| Limestone .....                      | 14         | 6   | 112       | 7  |        |
| Shale, gray.....                     | 3          | 0   | 115       | 7  |        |
| Limestone .....                      | 14         | 10  | 130       | 5  |        |
| Shale, gray.....                     | 13         | 10  | 144       | 3  |        |
| Slate .....                          | 4          | 5   | 148       | 8  |        |
| Coal, Sewickley.....                 | 6          | 2   | 154       | 10 | 154.9' |
| Slate .....                          | 4          | 6   | 159       | 4  |        |
| Shale, sandy, and fire clay.....     | 5          | 0   | 164       | 4  |        |
| Slate .....                          | 4          | 11  | 169       | 3  |        |
| Shale .....                          | 5          | 2   | 174       | 5  |        |
| Limestone .....                      | 1          | 4   | 175       | 9  |        |
| Shale .....                          | 10         | 0   | 185       | 9  |        |
| Sandstone .....                      | 12         | 1   | 197       | 10 |        |
| Shale .....                          | 12         | 6   | 210       | 4  |        |
| Slate and coal (Lower Sewickley).... | 1          | 1   | 211       | 5  | 56.5'  |
| Shale .....                          | 13         | 7   | 225       | 0  |        |
| Limestone .....                      | 3          | 6   | 228       | 6  |        |
| Shale .....                          | 1          | 3   | 229       | 9  |        |
| Limestone .....                      | 13         | 1   | 242       | 10 |        |
| Shale .....                          | 5          | 0   | 247       | 10 |        |
| Limestone .....                      | 1          | 3   | 249       | 1  |        |
| Shale .....                          | 4          | 5   | 253       | 6  |        |
| Slate .....                          | 2          | 2   | 255       | 8  |        |
| Shale .....                          | 12         | 5   | 268       | 1  |        |
| Sandstone .....                      | 8          | 5   | 276       | 6  |        |
| Slate .....                          | 5          | 4   | 281       | 10 |        |
| Coal .....0' 10" }                   |            |     |           |    |        |
| Slate .....0 7 } Pittsburgh (Bottom, |            |     |           |    |        |
| Coal .....9 2 } 668.2' L-A. T.)..    | 10         | 7   | 292       | 5  | 81'    |

The following shaft record was kindly furnished the Survey by the Four States Coal & Coke Company from its mine at Annabelle on Tevebaugh creek, Marion county:

**Air Shaft Record, Annabelle Mine.**

| (Elevation of top. 1048' L-A. T.)<br>Monongahela Series (303.2) | Thickness. |     | Total.  |
|---|------------|-----|---------|
|   | Ft.        | In. | Ft. In. |
| Top soil and red clay.....                                      | 7          | 0   | 7 0     |
| Sand and gravel.....  | 5          | 0   | 12 0    |
| Fire clay, soft.....  | 6          | 0   | 18 0    |
| Shale, gray.....  | 4          | 0   | 22 0    |
| Fire clay, hard gray.....                                       | 7          | 0   | 29 0    |
| Red shaly clay.....   | 3          | 0   | 32 0    |
| Shale, hard gray.....   | 2          | 0   | 34 0    |
| Fire clay soft.....   | 5          | 0   | 39 0    |
| Fire clay, sandy.....   | 6          | 0   | 45 0    |
| Fire clay.....  | 4          | 0   | 49 0    |
| Slate, black and hard.....                                      | 2          | 0   | 51 0    |
| Fire clay, soft.....  | 6          | 0   | 57 0    |

|  | Thickness. |     | Total. |     |
|--|------------|-----|--------|-----|
|  | Feet.      | In. | Feet.  | In. |
| Fire clay with streaks of shale.....   | 3          | 0   | 60     | 0   |
| Fire clay.....   | 23         | 0   | 83     | 0   |
| Fire clay and shale.....   | 4          | 0   | 87     | 0   |
| Limestone, gray.....   | 4          | 0   | 91     | 0   |
| Fire clay and red shale.....   | 2          | 0   | 93     | 0   |
| Limestone, white.....  | 7          | 0   | 100    | 0   |
| Fire clay.....   | 7          | 0   | 107    | 0   |
| Fire clay with streaks of shale.....   | 10         | 0   | 117    | 0   |
| Fire clay.....   | 6          | 0   | 123    | 0   |
| Limestone in ledges.....   | 5          | 6   | 128    | 6   |
| Limestone, white.....  | 4          | 3   | 132    | 9   |
| Fire clay.....   | 1          | 0   | 133    | 9   |
| Slate, black.....  | 2          | 10  | 136    | 7   |
| Limestone in ledges.....   | 3          | 5   | 140    | 0   |
| Limestone, brown.....  | 6          | 0   | 146    | 0   |
| Slate, black.....  | 2          | 6   | 148    | 6   |
| Limestone, brown.....  | 9          | 6   | 158    | 0   |
| Fire clay, soft.....   | 1          | 0   | 159    | 0   |
| Slate and fire clay.....   | 4          | 0   | 163    | 0   |
| Slate, black.....  | 2          | 6   | 165    | 6   |
| Limestone, brown.....  | 7          | 0   | 172    | 6   |
| Slate, black.....  | 2          | 4   | 174    | 10  |
| Coal, Sewickley (elevation, bottom,<br>867' L-A. T.).....  | 6          | 2   | 181    | 0   |
| Slate and fire clay.....   | 2          | 6   | 183    | 6   |
| Limestone, white.....  | 5          | 6   | 189    | 0   |
| Sandstone.....   | 1          | 6   | 190    | 6   |
| Fire clay and slate.....   | 2          | 6   | 193    | 0   |
| Soapstone and shale.....   | 2          | 6   | 195    | 6   |
| Sandstone, Lower Sewickley.....  | 20         | 0   | 215    | 6   |
| Slate, black.....  | 4          | 6   | 220    | 0   |
| Fire clay, soft.....   | 1          | 6   | 221    | 6   |
| Limestone, brown.....  | 7          | 6   | 229    | 0   |
| Limestone, white.....  | 6          | 0   | 235    | 0   |
| Sandstone, blue.....   | 13         | 0   | 248    | 0   |
| Limestone, brown.....  | 4          | 0   | 252    | 0   |
| Fire clay and slate.....   | 2          | 0   | 254    | 0   |
| Fire clay.....   | 5          | 0   | 259    | 0   |
| Fire clay, hard, and slate.....  | 10         | 0   | 269    | 0   |
| Slate, black.....  | 5          | 6   | 274    | 6   |
| Sandstone, Upper Pittsburgh.....   | 7          | 0   | 281    | 6   |
| Slate, black.....  | 10         | 8   | 292    | 2   |
| Draw slate.....  | 2          | 6   | 294    | 8   |
| Roof coal...0 9" }<br>Coal .....1 9½ }<br>Binder ....0 1½ }<br>Coal .....1 6 }<br>Binder .....0 0¼ } Pittsburgh<br>Coal .....0 11 } coal ..... 8 6¾ 303 2¾ 122.2'<br>Binder .....0 0½ }<br>Coal .....2 2¾ }<br>Binder .....0 0¼ }<br>Coal .....1 2 } |            |     |        |     |
| <b>Conemaugh Series (4')</b>   |            |     |        |     |
| Fire clay.....   | 1          | 6   | 304    | 8¾  |
| Sandstone, blue.....   | 2          | 6   | 307    | 2¾  |

A considerable area of the Monongaheia series has escaped erosion in Taylor county in that portion of the Ligonier Basin southwestward from Pruntytown.

The following section was measured with hand-level by Mr. Reger from the summit of a high knob, located 1 mile southwest of Pruntytown, Taylor county:

**Section One Mile Southwest of Pruntytown, Courthouse District.**

|   | Thickness. Total |       |        |
|---|------------------|-------|--------|
|   | Feet.            | Feet. |        |
| Concealed from top of knob.....             | 30               | 30    |        |
| Limestone, good.....                        | 2                | 32    |        |
| Concealed .....                             | 30               | 62    |        |
| Sandstone, shaly.....                       | 6                | 68    |        |
| Limestone, good, Benwood.....               | 5                | 73    |        |
| Concealed .....                             | 31               | 104   |        |
| Limestone .....                             | 2                | 106   |        |
| Shale, limy.....                            | 11               | 117   |        |
| Shale, brown and sandy.....                 | 17               | 134   |        |
| Slate, black, (Sewickley coal horizon)..... | 0.5              | 134.5 | 134.5' |
| Limestone, good .....                       | 2.5              | 137   |        |
| Shale, gray .....                           | 3                | 140   |        |
| Sandstone .....                             | 17               | 157   |        |
| Concealed .....                             | 88               | 245   |        |
| Coal, Pittsburgh.....                       | 7                | 252   | 117.5' |

Only the basal portion of the series has escaped erosion here, as is likewise noted in the following section measured by Reger southwestward from the summit of Plummer Knob.

**Plummer Knob Section, Courthouse District.**

|  | Thickness Total |       |
|--|-----------------|-------|
|  | Feet.           | Feet. |
| Sandstone, buff, medium grained, hard, capping knob..... | 20              | 20    |
| Concealed .....  | 60              | 80    |
| Sandstone, brown and flaggy.....                         | 13              | 93    |
| Limestone, Benwood.....                                  | 5               | 98    |
| Concealed .....  | 10              | 108   |
| Concealed and limy shale.....                            | 45              | 153   |
| Sandstone, brown and soft, Lower Sewickley               | 44              | 197   |
| Concealed .....  | 69              | 266   |
| Coal, Pittsburgh.....                                    | 8               | 274   |

## DESCRIPTION OF THE MONONGAHELA FORMATIONS.

### The Waynesburg Coal.

The **Waynesburg coal** is the topmost formation of the Monongahela series. It attains its best development of the entire Appalachian field in Monongalia and Marion counties, and is often named the "Mt. Morris coal" and "Fairview coal" by the oil and gas drillers. It is always multiple-bedded, and is frequently separated into only two benches, upper and lower, by a shale parting 1 to 36 inches thick, the whole sometimes attaining a thickness of 10 to 12 feet. Its crop is outlined in detail on Map II. Its thickness and relative position in the rock column are exhibited in the sections given in Chapter IV for Crossroads, Mooresville, Behler and Cassville in Monongalia; and for Glover Gap, Fairview, Rivesville, Dakota, Farmington, Downs, Worthington, Monongah N. W., Barrackville and Ices Run in Marion county. It is also recorded accurately in the log of the Absalom Martin Bore Hole (634A), page 220, of this chapter.

Several detailed sections of the bed, measured at crop, will now be given by magisterial districts.

**Monongalia County.**—An examination of Map II will show that the crop of the Waynesburg coal is confined in Monongalia to Cass, Grant and Clay districts, and that its horizon passes into the air on the steep western slope of the Indiana anticline before reaching the Monongahela river.

In **Cass district** the following section was measured at the Wade mine, located 1.2 miles southeast of Mt. Morris, Pa.:

#### Clark Wade Mine, Waynesburg Coal—No. 7 on Map II.

|  | Feet. | Inches |
|--|-------|--------|
| 1. Sandstone, massive, Waynesburg.....       |       |        |
| 2. Shale, Sandy. 6' 0" } Cassville.....      | 6     | 6      |
| 3. Shale, dark. .0 6 }                       |       |        |
| 4. Coal, bony... 0 5                         |       |        |
| 5. Coal ..... 2 6                            |       |        |
| 6. Shale, gray,<br>4" to 2 6                 |       |        |
| 7. Coal ..... 4 7                            |       |        |
| 8. Coal, slaty... 0 4                        |       |        |
| 9. Coal ..... 0 6      Waynesburg coal... 10 | 10    | 10     |
| 10. Slate .....                              |       |        |

(Elevation of coal, 985' A. T., aneroid).

A sample for analysis was collected from Nos. 5 and 7 of the section, the composition and calorific value of which are given under No. 7 (Laboratory No. 618H) in the table of coal analyses. A sample was also collected from the lower bench (No. 7) alone of the above section, the composition and calorific value of which are found under No. 7 (Laboratory No. 619H) of the same table. In each case the results show the coal to have slightly less than 1 per cent of sulphur and not over 10 per cent ash, a remarkable showing for a thick coal in a region where both the Sewickley and Pittsburgh beds have attained a fine development, all belonging in the Monongahela series.

The Wade mine has a large output for a country bank, the coal being sold to the farmers of the surrounding region for domestic fuel at the rate of  $3\frac{1}{2}$  cents a bushel. It is highly satisfactory as a domestic fuel, giving fine results when burned in an open grate.

The following section was measured at another mine in the Waynesburg coal in Cass district, 2 miles north  $15^\circ$  east of Cassville:

**Chas. Brand Mine, Waynesburg Coal.—No. 7(A) on Map II.**

|  | Feet. | Inches |
|--|-------|--------|
| Sandstone, massive, Waynesburg.....        | 50    | 0      |
| Shale, dark, Cassville, 0" to.....         | 0     | 6      |
| Coal .....                                 | 0' 4" |        |
| Shale .....                                | 0     | 2      |
| Coal .....                                 | 3     | 0      |
| Slate, gray.....                           | 0     | 4      |
| Coal .....                                 | 2     | 10     |
| Coal, slaty.....                           | 0     | 6      |
| Coal .....                                 | 1     | 1      |
|  | 8     | 3      |
| Slate .....                                |       |        |
| (Elevation of coal, 1130' A. T., aneroid). |       |        |

The thick middle slate of the Wade mine has here thinned to only 4 inches, and the total section of 8' 3" contains only 6 inches shale and slate along with 6 inches of slaty coal.

In the southwestern corner of Cass district the following section was measured at a mine in this coal, located 0.8 mile northwest of Cassville:

## Leander Sutton Mine, Waynesburg Coal.

|  | Feet. | Inches |
|--|-------|--------|
| Shale, gray and sandy.....                 | 5     | 0      |
| Coal .....                                 | 0' 5" |        |
| Shale, gray.....                           | 0     | 2      |
| Coal .....                                 | 1     | 2      |
| Shale .....                                | 0     | 1      |
| Coal .....                                 | 1     | 3      |
| Shale, gray.....                           | 1     | 3      |
| Coal .....                                 | 0     | 5      |
| Shale, gray .....                          | 0     | 3      |
| Coal .....                                 | 1     | 1      |
| Shale .....                                | 0     | 1      |
| Coal .....                                 | 1     | 0      |
| Shale, gray.....                           | 1     | 1      |
| Coal .....                                 | 1     | 1      |
| Coal, slaty.....                           | 0     | 4      |
| Coal .....                                 | 2     | 2      |
|  | 11    | 10     |
| Fire clay shale.....                       |       |        |
| (Elevation of coal, 1095' A. T., aneroid). |       |        |

The section shows the seam to be split up by several layers of shale with the best coal in the lower portion of the bed.

In Grant district, Monongalia, the Waynesburg coal attains a fine development as shown not only by well records but from several local mines on its crop. Along the northern border of the district the following section was measured at a mine, located 1.5 miles southwest of Charlotte and 200 yards northwest of the residence of Ray Hess:

## Hess Mine, Waynesburg Coal.

|   | Feet.  | Inches |
|---|--------|--------|
| Sandstone, massive, Waynesburg, visible.... | 20     | 0      |
| Shales, dark sandy, Cassville.....          | 12     | 0      |
| Coal, slaty.....                            | 0' 10" |        |
| Shale, gray.....                            | 0      | 3      |
| Coal .....                                  | 3      | 2      |
| Shale, gray.....                            | 0      | 10     |
| Coal .....                                  | 4      | 4      |
|   | 9      | 5      |
| Slate .....                                 |        |        |
| (Elevation of coal, 1220' A. T., aneroid).  |        |        |

Passing southwestward in Grant district, the following section was measured at a country bank in this coal, located 1.9 miles west of Laurel Point:

## A. H. Fox Mine, Waynesburg Coal.

|                                       | Feet.   | Inches |
|---------------------------------------|---------|--------|
| Sandstone, Waynesburg .....           |         |        |
| Shale, dark and sandy, Cassville..... | 12      | 0      |
| Coal .....                            | 0' 8"   |        |
| Shale, black.....                     | 0       | 2      |
| Coal .....                            | 3       | 0      |
| Shale, gray.....                      | 2" to 1 | 6      |
| Coal .....                            | 4 10    | 2      |
| Slate .....                           |         |        |

(Elevation of coal, 1120' A. T., aneroid).

The middle slate or gray shale appears to be quite variable in thickness at this mine, thinning from 18 inches to only 2 inches at one point in the mine.

Messrs. J. C. Heilig and R. C. Tucker of the Baltimore & Ohio R. R. engineering force, collected samples for analysis and measured the following sections at two country banks in the Waynesburg coal in Grant district, Monongalia, the results of which through the courtesy of C. McC. Lemley, Asst. Engineer of the same company, Morgantown, W. Va., were given to the Survey:

## W. A. Loar Mine.

Located 2 miles southwest of Laurel Point.

|                                 | Feet.  | Inches. |
|---------------------------------|--------|---------|
| 1. Sandstone roof.....          |        |         |
| 2. Coal .....                   | 3' 0 " |         |
| 3. Shaly sandstone ....         | 1      | 0       |
| 4. Coal .....                   | 1      | 2       |
| 5. Slate parting.....           | 0      | 0½      |
| 6. Coal .....                   | 0      | 2       |
| 7. Clay parting.....            | 1      | 3       |
| 8. Coal .....                   | 0      | 3       |
| 9. Clay .....                   | 0      | 0½      |
| 10. Bone coal.....              | 0      | 4       |
| 11. Coal .....                  | 0      | 4       |
| 12. Slate .....                 | 0      | 0½      |
| 13. Coal .....                  | 1      | 0       |
| 14. Slaty coal.....             | 0      | 4       |
| 15. Coal, appears clean....     | 1 5    | 10 4½   |
| 16. Fire clay shale bottom..... |        |         |

(Elevation, 1160' A. T., aneroid).

Butts, S 76° E; faces, S 14° W; sample collected from Nos. 4, 6, 8, 10, 11, 13, 14 and 15 of above section.



**Barker Mine.**

|   | Feet.  | Inches. |
|---|--------|---------|
| Located at Georgetown.  |        |         |
| 1. Sandstone roof.....  |        |         |
| 2. Coal .....   | 0' 8 " |         |
| 3. Slate .....  | 0 0½   |         |
| 4. Coal .....   | 0 4    |         |
| 5. Coal with ten slate<br>binders about every<br>two inches ..... | 1 10   |         |
| 6. Shale and clay part-<br>ings .....                             | 1 4    |         |
| 7. Coal .....   | 0 6    |         |
| 8. Clay .....   | 0 0½   |         |
| 9. Coal, 2' 3" to.....  | 3 3    | 7 11½   |
| 10. Fire clay bottom.....   |        |         |

Butts, S 75° E; faces, S 15° W; fuel used for domestic purposes and firing Georgetown mill. (Elevation, 1100' A. T., aneroid). Sample collected from Nos. 2, 4, 5, 7 and 9 of above section.

Messrs, Hite and Krak report the composition of the samples as follows:

|                      | W. A. Loar Mine<br>Per cent. | Barker Mine<br>Per cent. |
|----------------------|------------------------------|--------------------------|
| Moisture .....       | 1.86                         | 1.44                     |
| Volatile Matter..... | 30.00                        | 29.13                    |
| Fixed Carbon .....   | 53.56                        | 49.99                    |
| Ash .....            | 14.58                        | 19.44                    |
| Totals .....         | 100.00                       | 100.00                   |
| Sulphur .....        | 1.24                         | 1.88                     |
| Phosphorus .....     | 0.008                        | 0.039                    |

The extremely high percentage of ash in the Barker analysis is probably due to the inclusion of No. 5 of the section in the sample.

Passing westward in Grant district to the waters of Indian creek, the following section was measured at a country bank 1 mile southeast of Hagans:

|                             | Feet. | Inches. |
|-----------------------------|-------|---------|
| Shale, dark, Cassville..... | 6     | 0       |
| Coal, slaty.....            | 0' 1" |         |
| Shale, dark .....           | 0 9   |         |
| Coal .....                  | 1 0   |         |
| Shale, gray.....            | 1 6   |         |
| Cannel slate .....          | 3 0   |         |
| Coal .....                  | 1 5   |         |
| Coal, slaty.....            | 0 3   |         |
| Coal .....                  | 2 4   | 10 4    |
| Slate .....                 |       |         |

(Elevation of coal, 1035' A. T., aneroid).

A sample for analysis was collected and the following section measured at a country bank in this coal along the southwest edge of Grant district, Monongalia, located 1.8 miles northwest of Arnettsville:

**Wm. Glasscock Mine, Waynesburg Coal—No. 8 on Map II.**

|                     | Feet.  | Inches. |
|---------------------|--------|---------|
| 1. Shale .....      | 3      | 0       |
| 2. Coal .....       | 0' 11" |         |
| 3. Shale, gray..... | 1 3    |         |
| 4. Coal .....       | 3 2    | 4       |
| 5. Slate .....      |        |         |

(Elevation of coal, 1080' A. T., aneroid).

The composition and calorific value of the sample from No. 4 only of section as reported by Messrs. Hite and Krak. are given under No. 8 (Laboratory No. 620H) in the table of coal analyses. The results show the bed to be unusually high in sulphur and ash. The mine was just being opened when the sample was taken. An old mine in the same seam nearby has furnished domestic fuel for the farmers of the surrounding region for the last 40 to 50 years.

In Clay district, Monongalia, the Waynesburg coal barely gets above drainage in the extreme southeastern corner. Here the following section was measured at a country bank, 1 mile southwest of Hagans:

**Jacob R. Tennant Mine, Waynesburg Coal.**

|                           | Feet. | Inches. |
|---------------------------|-------|---------|
| Shale, dark .....         | 1     | 0       |
| Coal .....                | 0' 5" |         |
| Shale, gray.....          | 1 3   |         |
| Coal .....                | 4 0   |         |
| Slate, gray and hard..... | 0 5   |         |
| Coal .....                | 1 6   | 7       |

(Elevation of coal, 1040' A. T., aneroid).

**Marion County.**—Map II shows the crop of the Waynesburg coal in Pawpaw, Lincoln and Fairmont districts, the southeast corner of Mannington district, and the northwestern corner of Grant. It attains about the same development in Marion as in Monongalia.

In Pawpaw district this coal has been opened by farmers at a number of places along its crop for local domestic fuel. A sample for analysis was collected and the following section measured at one of these mines in the north edge of Fairview:

**John Statler Mine, Waynesburg Coal—No. 9 on Map II.**

|  | Feet.  | Inches. |
|--|--------|---------|
| 1. Sandstone, massive, Waynesburg..... | 50     | 0       |
| 2. Slate, black, Cassville.....        | 0      | 6       |
| 3. Coal .....                          | 0' 4 " |         |
| 4. Shale .....                         | 0 0½   |         |
| 5. Coal .....                          | 1 1    |         |
| 6. Shale, gray.....                    | 1 2    |         |
| 7. Coal .....                          | 3 2    | 5 9½    |
| 8. Slate .....                         |        |         |

(Elevation of coal, 1020' A. T., aneroid).

The composition and calorific value of the sample from Nos. 5 and 7 only of the section, as reported by Messrs. Hite and Krak, are given under No. 9 (Laboratory No. 613H) in the table of coal analyses.

One-half mile southward at the southeast edge of Fairview a sample for analysis was collected and the following section measured by Mr. Reger at a mine in the Waynesburg coal:

**C. J. Martin Mine, Waynesburg Coal—No. 10 on Map II.**

|                      | Feet. | Inches. |
|----------------------|-------|---------|
| 1. Shale, gray.....  |       |         |
| 2. Slate, black..... | 0     | 6       |
| 3. Coal, slaty.....  | 1' 1" |         |
| 4. Shale, gray ..... | 0 6   |         |
| 5. Coal, hard.....   | 2 8   | 4 3     |

(Elevation of coal, 1040' A. T., aneroid).

The composition and calorific value of the sample from the bottom bench only—No. 5 of section—as reported by Messrs. Hite and Krak, are given under No. 10 (Laboratory No. 647H) in the table of coal analyses.

Passing eastward to the waters of Little Pawpaw creek, this coal is opened at several country banks. The following section was measured at a mine, 1 mile south of McCurdyville:

**Brown Tennant Mine, Waynesburg Coal.**

|                             | Feet. | Inches. |
|-----------------------------|-------|---------|
| Concealed .....             |       |         |
| Shale, dark, Cassville..... | 10    | 0       |
| Coal .....                  | 0' 9" |         |
| Shale, gray.....            | 1 2   |         |
| Coal .....                  | 4 3   | 6 2     |
| Fire clay shale.....        |       |         |

Here the upper bench has almost thinned away, while the lower one has its normal thickness of the Monongalia region to the northeast.

Passing about 3 miles southeastward in Pawpaw district we find the following section exposed at a country bank, 1 mile southwest of Arnettville:

**Alfred Valentine Mine, Waynesburg Coal.**

|  | Feet. | Inches. |
|--|-------|---------|
| Shale .....                                |       |         |
| Coal .....                                 | 1' 0" |         |
| Shale, gray.....                           | 1 3   |         |
| Coal .....                                 | 4 4   | 6 7     |
| Fire clay shale.....                       |       |         |
| (Elevation of coal, 1130' A. T., aneroid). |       |         |

Through the courtesy of C. McC. Lemley, Assistant Engineer, Baltimore & Ohio Railroad Co., the Survey obtained an analysis of a sample of this coal from an opening on the same farm, 100 yards northward from the last mentioned mine. The sample was collected by Messrs. Heilig and Tucker, and the results, as determined by J. B. Krak of the Survey staff, are as follows:

|                      | Per cent. |
|----------------------|-----------|
| Moisture .....       | 1.23      |
| Volatile Matter..... | 29.32     |
| Fixed Carbon.....    | 46.62     |
| Ash .....            | 22.83     |
| Total .....          | 100.00    |
| Sulphur .....        | 2.93      |
| Phosphorus .....     | 0.008     |

Messrs. Heilig and Tucker report only 2' 7½" of the lower bench from which the sample was taken, with ¼" sulphur band 8" above the bottom, the band being excluded from the sample. The faulty nature of this opening as compared to that measured by the writer above, 100 yards southward, probably accounts for the high percentage of ash.

In the extreme southern point of Pawpaw district, this coal is opened on the river hill, 1 mile southwest of Rivesville. Here Reger collected a sample for analysis and measured the following section:

**Monongahela Valley Traction Co. Mine, Waynesburg Coal.  
No. 11 on Map II.**

|                     | Feet.    | Inches.  |
|---------------------|----------|----------|
| 1. Coal .....       | 0        | 8        |
| 2. Shale, gray..... | 1        | 3        |
| 3. Coal, good.....  | 0        | 9        |
| 4. Coal, bony.....  | 0        | 8        |
| 5. Coal, good.....  | 2        | 1        |
| <b>Total .....</b>  | <b>5</b> | <b>5</b> |

(Elevation of coal, 1038' A. T., spirit leveled).

The composition and calorific value of the samples from No. 1, 3 and 5 only of section, as reported by Messrs. Hite and Krak, are given under No. 11 (Laboratory No. 649H) in the table of coal analyses. The results shows the coal fairly high in sulphur, but containing slightly less than 11 per cent of ash.

In Lincoln district, Marion, the Waynesburg coal attains good development and has been mined at many places to furnish local domestic fuel. Along the northeastern border of the district, Reger measured the following section at an opening, 1 mile north of Upton:

|   | Feet. | Inches. |
|---|-------|---------|
| Sandstone, massive, Waynesburg.....     | 50    | 0       |
| Shale, gray.....0' 6" } Cassville ..... | 1     | 0       |
| Slate, black.....0 6 }                  |       |         |
| Coal, soft.....1' 10" } Waynesburg .... | 6     | 4       |
| Slate, gray.....1 6 }                   |       |         |
| Coal, hard.....3 0 }                    |       |         |

(Elevation of coal, 1140' A. T., aneroid).

Five to six miles southwestward in Lincoln district, Reger measured the following section at the crop of the Waynesburg seam in the public road on Mod run, one-fourth mile northeast of Downs:

|   | Feet.             | Inches. |
|---|-------------------|---------|
| Sandstone, massive, Waynesburg.....       | 30                | 0       |
| Shale, gray, Cassville.....               | 4                 | 0       |
| Coal .....1' 0"                           | } Waynesburg coal | 6       |
| Slate .....0 6                            |                   |         |
| Coal .....0 6                             |                   |         |
| Shale, gray.....2 0                       |                   |         |
| Coal .....2 4                             |                   |         |
| Shale, gray and concealed.....            | 10                | 0       |
| Sandstone in run, visible, Gilboy.....    | 15                | 0       |
| (Elevation of coal, 1035 A. T., aneroid). |                   |         |

Although the total thickness of the bed is the same in the last two sections, yet the latter carries one foot less coal.

Slightly over a mile southeast of Downs, Reger measured the following section in the Waynesburg bed at a mine near the H. L. Sturm No. 1 gas well (626):

|  | Feet.             | Inches. |
|--|-------------------|---------|
| Sandstone, massive, brown and pebbly<br>Waynesburg ..... |                   |         |
| Slate, black.....  |                   |         |
| Coal .....0' 2"  | } Waynesburg coal | 3       |
| Slate, black.....0 1                                     |                   |         |
| Coal .....0 8  |                   |         |
| Shale, gray.....0 2                                      |                   |         |
| Coal .....0 9  |                   |         |
| Shale, gray.....0 8                                      |                   |         |
| Coal .....1 0  |                   |         |
| (Elevation of coal, 1080' A. T., spirit level).          |                   |         |

Here, according to the log of the Sturm well (626), the base of the coal comes 400 feet above the top of the Pittsburgh seam, and—as Mr. Reger determined by hand-level—103 feet above the Uniontown coal.

Two miles northeastward, the Waynesburg coal crops on Laurel run, and there Reger measured the following section of the bed:

**C. J. Lough Mine, Waynesburg Coal.**

|                                     | Feet. | Inches. |
|-------------------------------------|-------|---------|
| Sandstone, massive, Waynesburg..... | 50    | 0       |
| Shale, gray.....                    | 1     | 0       |
| Slate, hard and black.....          | 0     | 9       |
| Shale, gray.....                    | 0     | 2       |

|  |       |   |   |
|--|-------|---|---|
| Coal .....   | 0' 3" |   |   |
| Shale, gray.....                                     | 0 1   |   |   |
| Coal, good.....                                      | 1 1   |   |   |
| Shale, gray.....                                     | 0 6   |   |   |
| Coal, bony.....                                      | 0 7   |   |   |
| Coal, good (not visible, supplied by Mr. Lough.....) | 2 0   | 4 | 6 |

(Elevation of coal, 1080' A. T., aneroid).

Before the opening of the Pittsburgh bed at Farmington, this coal was mined quite extensively to furnish domestic fuel for the surrounding neighborhood.

Pasing eastward to Davy run in the eastern edge of Lincoln district this coal is found cropping a short distance above drainage, 1.4 miles northward from Katy, where Reger measured the following section:

|                                     | Feet.                | Inches. |
|-------------------------------------|----------------------|---------|
| Sandstone, massive, Waynesburg..... |                      |         |
| Shale, gray, Cassville.....         | 4                    | 0       |
| Coal, slaty.....2' 0"               | } Waynesburg coal... | 7 0     |
| Shale, gray.....1 2                 |                      |         |
| Coal, hard, block .1 3              |                      |         |
| Slate, black.....0 1                |                      |         |
| Coal, good.....2 6                  |                      |         |

Southwestward from the main line of the B. & O. R. R. in Lincoln district the Waynesburg coal has been mined quite extensively for local domestic fuel by farmers. The following section was measured at an opening on Little Mill Fall run, 2 miles northwest of Monongah, near the J. L. Jones core test well (660), the record of which is published on pp. 676-677 of Vol. II(A) of the State Survey reports:

#### J. L. Jones Mine, Waynesburg Coal.

|                            | Feet.  | Inches. |
|----------------------------|--------|---------|
| Sandstone, Waynesburg..... | 50     | 0       |
| Coal .....                 | 0' 10" |         |
| Shale, gray.....           | 0 2    |         |
| Coal .....                 | 1 0    |         |
| Shale, gray.....           | 1 3    |         |
| Coal, bony.....            | 0 3    |         |
| Coal .....                 | 1 3    |         |
| Coal, bony .....           | 0 2    |         |
| Coal .....                 | 1 11   | 6 10    |

Fire clay shale.....  
(Elevation of coal, 1155' A. T., aneroid).

The coal is 5 inches thicker than recorded in the log of the boring (660) referred to above. The middle slate of the Mt. Morris region is present in typical development.

Two miles southwestward in Lincoln district a sample for analysis was collected and the following section measured by Reger at a farmer's opening:

**W. I. Nutter Mine, Waynesburg Coal.—No. 12 on Map II.**

|  | Feet. | Inches. |
|--|-------|---------|
| 1. Sandstone, massive, Waynesburg..... | 40    | 0       |
| 2. Shale, gray, Cassville.....         | 2     | 0       |
| 3. Slate, black.....                   | 0     | 6       |
| 4. Coal.....0' 8"                      |       |         |
| 5. Shale, gray.....0 2                 |       |         |
| 6. Slate, black and soft...0 6         |       |         |
| 7. Coal, soft.....1 1                  |       |         |
| 8. Shale, gray.....1 4                 |       |         |
| 9. Coal, hard.....2 8                  | 6     | 5       |
| 10. Fire clay shale.....               |       |         |

(Elevation of coal, 1200' A. T., aneroid).

The composition and calorific value of the sample from Nos. 7 and 9 only of the section as reported by Messrs. Hite and Krak, are found under No. 12 (Laboratory No. 642H) in the table of coal analyses. The sulphur content is quite high, but the ash is about what should be expected.

The Waynesburg coal appears to thin down rapidly southwestward in Lincoln district as the Harrison county line is approached, as revealed by the following section measured by Reger at a mine on Camp run, 1 mile northwest of Hutchinson, just east of the point where the public road crosses the latter stream:

|   | Feet. | Inches. |
|---|-------|---------|
| Sandstone, massive, brown, Waynesburg.... | 55    | 0       |
| Slate.....                                | 0     | 3       |
| Coal.....0' 8" } Waynesburg coal... 3 3   |       |         |
| Shale, gray.....1 4                       |       |         |
| Coal.....1 0                              |       |         |
| Shale, gray, ferriferous.....             | 5     | 0       |
| Sandstone, Gilboy.....                    | 10    | 0       |

(Elevation of coal, 1150' A. T., aneroid).

Here, as southwestward in Harrison county, it is too thin to be considered of any commercial value. Two and a half



miles northward in the same district it again resumes its normal thickness on a branch of Helens run, near the Clement Davis No. 1 well (644), where Reger measured the following section at an exposure in the run:

|   | Feet. | Inches. |
|---|-------|---------|
| Sandstone, massive, Waynesburg.....                       | 30    | 0       |
| Shales, dark fossil<br>plants .....0' 4" } Cassville .... | 1     | 0       |
| Shale, gray and hard...0 8 }                              |       |         |
| Coal, slaty.....0' 4"                                     |       |         |
| Slate, gray.....0 1                                       |       |         |
| Coal, good.....1 1  |       |         |
| Shale, gray.....2 6                                       |       |         |
| Coal, slaty.....0 4                                       |       |         |
| Slate, black.....0 1                                      |       |         |
| Coal, good.....0 7  |       |         |
| Shale, gray.....1 2                                       |       |         |
| Coal, hard, slaty at top.....3 0                          | 9     | 2       |
| <hr/>   |       |         |
| Concealed .....   | 3     | 0       |
| Sandstone, massive, Gilboy.....                           | 35    | 0       |
| (Elevation of coal, 1090' A. T., aneroid).                |       |         |

Here the bed contains 3' 10" of slate and shale.

Passing six miles southwestward to Big run, the following section was obtained by Reger at an exposure along the road, one-fourth mile southwest of the R. J. Martin No. 1 gas well (545):

|  | Feet. | Inches. |
|--|-------|---------|
| Shale, gray.....                       | 5     | 0       |
| Coal .....0' 8" } Waynesburg coal... . | 4     | 8       |
| Shale, gray.....1 6 }                  |       |         |
| Coal, good.....2 6 }                   |       |         |
| Concealed .....                        | 5     | 0       |

In **Mannington district**, Marion, the Waynesburg coal rises above drainage in the extreme southeast corner. Mr. Reger obtained the following section of the coal 0.9 mile eastward from Pleasantville:

|  | Feet. | Inches. |
|--|-------|---------|
| Sandstone, massive, Waynesburg.....        |       |         |
| Slate, black.....                          | 0     | 3       |
| Shale, gray.....                           | 1     | 0       |
| Coal, Waynesburg.....                      | 2     | 6       |
| Shale, gray.....                           | 5     | 0       |
| Sandstone, massive, Gilboy.....            | 10    | 0       |
| (Elevation of coal, 1095' A. T., aneroid). |       |         |

In Fairmont district, the Waynesburg coal crops high in the hills over a large portion of its area, attaining a fair development. The following section was measured by Reger in the northern point of the district on the head of Finch run, near the Eli M. Rex No. 1 well (664) :

|  | Feet.                | Inches. |
|--|----------------------|---------|
| Shale, gray.....                           | 1                    | 0       |
| Coal .....0' 11"                           | } Waynesburg coal... | 4 11    |
| Shale, gray .....1 3                       |                      |         |
| Coal, good.....1 5                         |                      |         |
| Slate, black.....0 4                       |                      |         |
| Coal, good.....1 0                         |                      |         |
| Concealed by water.....                    |                      |         |
| (Elevation of coal, 1103' A. T., aneroid). |                      |         |

Slightly over two miles southeastward this coal has been opened on the east side of Finch run,  $\frac{3}{4}$  mile due north of Barrackville, where the following section was measured by Reger:

|  | Feet.                | Inches. |
|--|----------------------|---------|
| Shale, gray, Cassville.....                | 3                    | 0       |
| Coal .....0' 5"                            | } Waynesburg coal... | 5 2     |
| Shale, gray.....1 2                        |                      |         |
| Coal .....0 10                             |                      |         |
| Slate, black.....0 1                       |                      |         |
| Coal .....2 8                              |                      |         |
| Shale, gray.....                           |                      |         |
| (Elevation of coal, 1055' A. T., aneroid). |                      |         |

In the central portion of Fairmont district a detailed section of the Waynesburg coal near the head of Little Coal run is given in the general Ices Run-Fairmont section, page 140.

**Grant district**, Marion county lies in the angle between the West Fork and Tygart Valley rivers. A glance at Map II will show that only a few small patches along the western border of the district remain uneroded. No openings on its crop were observed in this area, so that it was not possible to determine the thickness. The Monongah S. E. general section, page 142, exhibits only a streak of black slate at this horizon, but the coal itself may belong in the concealed interval immediately under this black slate.

**Taylor County.**—The Waynesburg coal has been entirely eroded in Taylor county except a few small patches in the southern portion of Flemington district. These occur in the

deep Ligonier structural basin, south and southwest of Flemington as shown on Map II, near the summits of high hills. The coal is apparently too thin in this region to have any commercial value, although no measurements were obtained of its exact thickness and bedding, due to lack of openings.

### The Gilboy Sandstone.

At 5 to 10 feet below the Waynesburg coal there frequently occurs a very hard, fine grained, grayish white rock, 25 to 35 feet thick, that has been termed the **Gilboy sandstone** by I. C. White<sup>1</sup> from a railroad cut of that name just east of Mannington, Marion county.

Its crop follows closely that outlined for the Waynesburg coal on Map II. Its thickness and relative position in the rock column are exhibited in the sections for Mannington, Fairview, Farmington, Rivesville, Downs, Monongah N. W., and Barrackville.

Only one quarry was noted on this ledge. According to Reger, the Jamison Coal & Coke Co. has quarried this stratum along with the Waynesburg above for masonry work in its plant at Mine No. 8, at Underwood. Here the ledge is reported very broken in appearance, with numerous bedding and joint planes, some of the layers being very much cross-bedded and separated by layers of shale.

### The Little Waynesburg Coal.

The **Little Waynesburg coal** of J. J. Stevenson, belonging 25 to 40 feet below the Waynesburg coal, was noted at only one point in the three counties; viz., along the Woods run hill road, 0.6 mile southwest of Stafford, Marion county, where Reger obtained the following section:

|  | Feet. | Inches. |
|--|-------|---------|
| Coal, Waynesburg.....  | 4     | 7       |
| Concealed .....  | 20    | 0       |
| Sandstone, massive, gray, micaceous, medium grained, Gilboy..... | 25    | 0       |
| Concealed .....  | 9     | 0       |
| Coal, slaty, Little Waynesburg (980' B-A. T.)                    | 1     | 0       |
| Limestone, hard, Waynesburg.....                                 | 10    | 0       |

1. Vol II, W. Va. Geol. Survey, p. 150; 1903.

The coal is too thin to have any economic importance in the area under discussion.

### The Waynesburg Limestone.

The **Waynesburg limestone** of Stevenson and White was observed at only two localities; viz., that given for Little Waynesburg coal, where the section above shows it 10 feet thick, coming immediately under the latter coal; again on Plum run, Marion county, 1 mile northeast of Downs where a sample for analysis was collected and the following section measured by Reger at its crop on the land of Eliza Huff:

|                                      | Feet. |
|--------------------------------------|-------|
| 1. Coal, Waynesburg.....             | 5     |
| 2. Shale and concealed.....          | 5     |
| 3. Sandstone, Gilboy.....            | 22    |
| 4. Coal, Little Waynesburg (3")..... | 0.25  |
| 5. Limestone, hard, Waynesburg.....  | 2     |

The composition of the sample as reported by Messrs. Hite and Krak under Laboratory No. 644H(a) is as follows:

|   | Per cent.    |
|---|--------------|
| Silica (Si O <sub>2</sub> ).....                      | 12.43        |
| Ferric Iron (Fe <sub>2</sub> O <sub>3</sub> ).....    | 2.42         |
| Alumina (Al <sub>2</sub> O <sub>3</sub> ).....        | 1.79         |
| Calcium Carbonate (Ca CO <sub>3</sub> ).....          | 77.62        |
| Magnesium Carbonate (Mg CO <sub>3</sub> ).....        | 3.22         |
| Phosphoric Acid (P <sub>2</sub> O <sub>5</sub> )..... | 0.30         |
| Loss on ignition.....                                 | 2.12         |
| <b>Total</b> .....                                    | <b>99.90</b> |

The results show it adapted to the manufacture of agricultural lime and road material:

It is evidently lenticular in its nature, since it is entirely absent in many places where its horizon is exposed in Monongalia and Marion counties.

### The Uniontown Sandstone.

The **Uniontown sandstone** of I. C. White<sup>3</sup> does not attain the developemnt in the Monongalia-Marion-Taylor area that

3. Bulletin 65, U. S. G. Survey, p. 58; 1891.

it does southwestward in the State, as it has a tendency to break up into shales and sandy beds. The general sections for Dakota, Farmington, Barrackville, Ices Run-Fairmont, and Monongah S. E. exhibit its thickness and relative position in the rock column.

Only one quarry was observed on the ledge in the three counties. This was on Pawpaw creek, opposite the mouth of Toothman run, one mile northwest of Grays Flat. Here it had been quarried for ballast by the Fairmont & Clarksburg Traction Co. for the electric railroad running from Fairmont to Fairview. At this point it is 20 feet thick and comes immediately above 7 feet of hard, gray limestone, at an elevation of 995' A.T. by aneroid.

#### **The Annabelle Shale.**

On Tevebaugh creek at Annabelle, Marion county, the Uniontown sandstone has been largely replaced by a greenish gray and brown shale, according to Reger, where it has been utilized quite successfully by the United States Sewer Pipe Company to manufacture brick for the plant and houses of the Four States Coal & Coke Co. at this place. A more detailed discussion of the clay pit and an analysis of the shale will be given in a subsequent chapter under Clays. Its thickness and relative position in the rock column are noted in the general sections for Farmington and Barrackville. It appears to be confined largely to the southern portions of Lincoln and Fairmont districts, Marion county. It has been termed the **Annabelle shale** by Reger in gathering his notes in the field.

#### **The Uniontown Coal.**

The **Uniontown coal** of Rogers comes 90 to 110 feet below the Waynesburg coal and about 300 feet above the Pittsburgh bed. Its thickness and relative position in the rock column are exhibited in the general sections for Worthington, Monongah N. W., Barrackville and Ices Run-Fairmont, and in the records of the two following diamond drill borings:

Morgan-Fox No. 14 (621), located 0.5 mile north of Farmington.

Jane Downs No. 4 (640A), located 1.8 miles northwest of Festus.

The following section was measured at its crop on Pawpaw creek, 0.8 mile northwest of Grays Flat:

|  | Feet.             | Inches. |
|--|-------------------|---------|
| Shale, gray.....                           | 0                 | 2       |
| Coal, slaty.....0' 4½"                     | } Uniontown ..... | 1 4     |
| Shale, gray.....0 2½"                      |                   |         |
| Coal .....0 9"                             |                   |         |
| Shale, gray.....                           | 3                 | 0       |
| (Elevation of coal, 1000' A. T., aneroid). |                   |         |

The section shows the coal double-bedded, a feature that almost invariably accompanies this seam.

Mr. Reger reports it only 6 inches thick at Farmington, at an elevation of 955' A.T., aneroid; and 12 inches thick, 0.3 mile northeast of Bingamon, at an elevation of 1080' A.T., aneroid.

Sufficient data have been obtained to show that this coal is too thin, impure, and irregular in the three counties to be classed as a minable coal.

### The Uniontown Limestone.

The Great Limestone of the First Geological Survey of Pennsylvania was divided by J. J. Stevenson; the **Upper**, 6 to 18 feet thick, coming immediately below the Uniontown coal, was termed the **Uniontown limestone** from its relation to the coal bed. Its thickness, character and relative position in the rock column are exhibited in the general sections for Rivesville, Dakota, Farmington, Worthington and Barrackville. Its outcrop is 100 to 120 feet in elevation below that outlined for the Waynesburg coal on Map II, wherever the latter gets more than that distance above drainage. It is usually buffish gray in color, slightly magnesian and 3 to 10 feet in thickness. It appears to attain a better development in Marion than in either of the other two counties. On Pawpaw creek its crop is well exposed opposite the mouth of Toothman run, 1 mile northwest of Grays Flat, at an elevation

of 990' A.T., aneroid. Here it is gray, hard and 7 feet thick, coming immediately at the base of the Uniontown sandstone, the latter being quarried for ballast. The sandstone has cut away the Uniontown coal entirely.

Mr. Reger collected a sample of this limestone for analysis and measured the following section at its crop on the south bank of Buffalo creek at Farmington (Underwood Sta.):

|   | Feet. | Inches. |
|---|-------|---------|
| Shale, brown, Annabelle.....                  | 15    | 0       |
| Slate, black coaly, Uniontown, 0 to.....      | 0     | 6       |
| Limestone, hard, Uniontown (950' B-A. T.).... | 3     | 0       |
| Shale, limy, greenish at base.....            | 15    | 0       |

The composition of the sample is reported by Messrs. Hite and Krak as follows:

|   | Per cent. |
|---|-----------|
| Silica (Si O <sub>2</sub> ).....                      | 31.63     |
| Ferric Iron (Fe <sub>2</sub> O <sub>3</sub> ).....    | 2.95      |
| Alumina (Al <sub>2</sub> O <sub>3</sub> ).....        | 8.14      |
| Calcium Carbonate (Ca CO <sub>3</sub> ).....          | 49.00     |
| Magnesium Carbonate (Mg CO <sub>3</sub> ).....        | 2.43      |
| Phosphoric Acid (P <sub>2</sub> O <sub>5</sub> )..... | 1.02      |
| Loss on ignition.....                                 | 4.73      |
| Total .....   | 99.90     |

The results show it too high in silica to have much value except for road material.

### The Arnoldsburg Sandstone.

The Arnoldsburg sandstone of the writer<sup>4</sup> comes 40 to 50 feet below the Uniontown sandstone at the type locality of the former. Its thickness and relative position in the rock column are exhibited in the general sections for Downs and Tyrconnell. This stratum ranges from 15 to 30 feet thick, and it is very close-grained in texture with a greenish to bluish gray color on fresh fractures, but on old exposures changes to a brownish gray color. It is this ledge and not the Sewickley that is quarried and mined in the north edge of

4. Ray V. Hennen, Wirt-Roane-Calhoun, Rept., W. Va. G. Survey, pp. 202-204; 1911.

Fairmont by Mr. J. Fay Watson, an account of which is given by G. P. Grimsley on pages 459-460 of Vol. IV of the State Survey reports. Here it comes about 200 feet above the Pittsburgh coal and 115 feet above the Sewickley coal. It frequently forms steep bluffs around the hillsides about 175 feet below the crop of the Waynesburg coal.

### The Lower Uniontown Coal.

In northern Harrison and southern Marion counties there occurs a thin coal, 10 to 18 inches thick, about midway between the Uniontown and Sewickley coals that is known as the Lower Uniontown bed. Its thickness and relative position in the rock column are exhibited in the general sections for Randall and Worthington and in the logs of the two following diamond drill borings, published on preceding pages of this report:

Jessie B. Martin No. 10 (623), located 1.5 miles S W of Farmington.

Wm. Sandy No. 12 (653), located 0.5 mile west of Hutchinson.

Through the courtesy of Frank Haas of the Consolidation Coal Co., the Survey obtained the following analysis of this coal as tested in the laboratories of the company from the core taken out of the Martin boring (623), see page 218:

|                       | Per cent. |
|-----------------------|-----------|
| Molsture .....        | 1.54      |
| Volatile Matter ..... | 38.54     |
| Fixed Carbon.....     | 51.16     |
| Ash .....             | 8.76      |
|                       | <hr/>     |
| Total .....           | 100.00    |
| Sulphur .....         | 3.56      |

On Tevebaugh creek, 1.2 miles northwest of Worthington, Reger collected a sample of this coal for analysis and measured the following section at a fresh exposure in a railroad cut, marked No. 13 on Map II:



|                                      | Feet. | Inches. |
|--------------------------------------|-------|---------|
| Sandstone, massive, Arnoldsburg..... | 20    | 0       |
| Shale .....                          | 4     | 0       |
| Coal, good Lower Uniontown.....      | 2     | 4       |
| Shale, brown.....                    | 0     | 4       |
| Limestone, gray, very hard.....      | 1     | 0       |
| Limestone, shaly .....               | 3     | 0       |
| Limestone, hard.....                 | 4     | 0       |

The composition and calorific value of the sample, as reported by Messrs. Hite and Krak. are given under No. 13 (Laboratory No. 641H) in the table of coal analyses.

The coal is too thin and irregular to be reckoned as a valuable economic asset, since the logs of several of the diamond drill borings in the region where it attains its best development reveal its entire absence.

### The Fulton Green Shale.

The **Fulton Green** shale of Grimsley<sup>5</sup> comes 80 to 90 feet above the Sewickley coal and directly over the Benwood limestone. It is a bright green, finely laminated shale on fresh exposure, weathering to a bluish green. The following section was measured by Mr. Reger at its crop near the B. & O. R. R. Station at Barrackville, Marion county:

|   | Feet. | Inches. |
|---|-------|---------|
| Sandstone, massive..4' } Arnoldsburg .....      | 15    | 0       |
| Shale .....5' }                                 |       |         |
| Sandstone, massive..6' }                        |       |         |
| Shale .....                                     | 3     | 0       |
| Limestone, shaly.....                           | 10    | 0       |
| Shale, green, Fulton.....                       | 7     | 0       |
| Limestone, Benwood, to railroad grade.....      | 7     | 0       |
| (Elevation of shale, 913' A. T., spirit level). |       |         |

The formation is of scientific interest on account of its wide distribution, being found at the same horizon in Harrison and also in Barbour county, near Century.

### The Benwood Limestone.

The **Benwood limestone**, a name applied to the lower division of the Great Limestone of Rogers by I. C. White

5. G. P. Grimsley, Ohio-Brooke-Hancock Rept., W. Va. G. Survey, p. 92; 1906.

from the town of Benwood, Marshall county, where it crops in prominent cliffs, attains a fair development in this area. Its thickness and relative position in the rock column therein are exhibited in the general sections for Dakota, Farmington, Downs, Worthington, Monongah N W, Ices Run-Fairmont, Monongah S E, Tyrconnell and Pruntytown. It crops 100 to 125 feet in elevation above the Pittsburgh coal, and is of brackish or fresh-water origin.

In **Monongalia county** this formation crops on the waters of Robinson, Scott and Dents runs and other west side tributaries of the Monongahela river. The following analysis of a sample from this limestone on Scott run, Cass district, was published on page 94 of the Ohio-Brooke-Hancock Report of the State Geological Survey:

|                           | Per cent. |
|---------------------------|-----------|
| Lime carbonate .....      | 86.70     |
| Magnesium carbonate ..... | 5.32      |
| Silica .....              | 5.96      |
| Alumina .....             | 1.06      |
| Iron oxide .....          | 1.27      |
| Titanium .....            | 0.07      |

In **Marion county** this limestone crops along the Monongahela, West Fork and Tygart Valley rivers, and a short distance back up the tributaries of the latter streams within the boundaries of the Monongahela series as outlined on Map II.

Mr. Reger collected a sample for analysis and measured the following section at an exposure in a Baltimore & Ohio Railroad cut, one-eighth mile south of Montana Mines:

|                          | Feet. |     |
|--------------------------|-------|-----|
| 1. Limestone, hard.....  | 4     |     |
| 2. Limy, shale.....      | 15    |     |
| 3. Limestone, hard ..... | 8     |     |
| 4. Limestone, shaly..... | 9     |     |
| 5. Limestone, hard.....  | 4     |     |
| 6. Shale, limy.....      | 3     | 43' |
| 7. Coal, Sewickley ..... |       |     |

The composition of the sample from Nos. 1, 3 and 5 only of section is reported by Messrs. Hite and Krak as follows:

|   | Per cent.     |
|---|---------------|
| Silica (Si O <sub>2</sub> ).....                      | 18.79         |
| Ferric Iron (Fe <sub>2</sub> O <sub>3</sub> ) }       |               |
| Alumina (Al <sub>2</sub> O <sub>3</sub> ) }           | 5.79          |
| Calcium Carbonate (Ca CO <sub>2</sub> ).....          | 26.56         |
| Magnesium Carbonate (MgCO <sub>3</sub> ).....         | 37.51         |
| Phosphoric Acid (P <sub>2</sub> O <sub>5</sub> )..... | 0.22          |
| Loss on ignition and undetermined.....                | 11.13         |
| <b>Total</b> .....                                    | <b>100.00</b> |

The high percentage of magnesium carbonate classes this limestone as dolomitic and adapted to the manufacture of natural cement. It should also furnish an abundance of road metal.

It is this limestone, according to Reger, that has been quarried for road metal along the river hill east of Fairmont where the following section was measured:

|                                     | Feet. | Inches. |
|-------------------------------------|-------|---------|
| Shale, green, Fulton.....           | 5     | 0       |
| Limestone, massive, hard 10' }      |       |         |
| Shale, limy.....20 }                | 20    | 0       |
| Limestone, shaly.....35 }           | 35    | 0       |
| Shale, yellow and limy... 7 }       | 7     | 0       |
| Coal, Sewickley (935' B.A. T.)..... | 3     | 4       |

In Taylor it does not attain the development that it does in the other two counties. However, it adds greatly to the fertility of the soil southwestward from Pruntytown to the Taylor-Harrison line.

Mr. Reger collected a sample for analysis and measured the following section at an exposure of this limestone 1¼ miles southwest of Pruntytown:

|                                  | Feet. | Inches. |
|----------------------------------|-------|---------|
| 1. Sandstone, shaly.....         | 6     | 0       |
| 2. Limestone, good, Benwood..... | 5     | 0       |
| 3. Concealed .....               | 31    | 0       |
| 4. Limestone .....               | 2     | 0       |
| 5. Interval .....                | 139   | 0       |
| 6. Coal, Pittsburgh.....         | 7     | 0       |

(Elevation of Benwood Limestone, 1462' A. T., spirit level).

The composition of the sample from No. 2 only of section, is reported by Messrs. Hite and Krak as follows:

|   | Per cent. |
|---|-----------|
| Silica ( $\text{Si O}_2$ ).....                 | 8.70      |
| Ferric Iron ( $\text{Fe}_2\text{O}_3$ ).....    | 1.61      |
| Alumina ( $\text{Al}_2\text{O}_3$ ).....        | 0.84      |
| Calcium Carbonate ( $\text{Ca CO}_3$ ).....     | 84.16     |
| Magnesium Carbonate ( $\text{Mg CO}_3$ ).....   | 2.23      |
| Phosphoric Acid ( $\text{P}_2\text{O}_5$ )..... | 0.65      |
| Loss on ignition.....                           | 1.79      |
| Total .....                                     | 99.98     |

The results show it to be adapted both to the manufacture of agricultural lime and road material.

### The Upper Sewickley Sandstone.

A massive, arenaceous stratum, 40 to 60 feet thick, crops directly over the Sewickley coal along the Monongahela river in Monongalia and Marion counties, and this has been designated the **Sewickley sandstone** by I. C. White<sup>6</sup>. Its thickness and relative position in the measures are exhibited in the general sections for Mooresville, Behler and Randall in Monongalia; and for Fairview, Farmington, Downs and Monongah N W in Marion. It was not noted in any of the sections of the Monongahela series in Taylor. This sandstone is especially prominent opposite Beechwood, in Monongalia, where it crops in a great cliff 60 feet high. No quarries were observed on this ledge.

### The Sewickley Coal.

The **Sewickley coal**, so named by the First Geological Survey of Pennsylvania, comes 75 to 120 feet above the base of the Monongahela series, and ranks next to the Pittsburgh bed in economic importance. Its crop follows closely the region outlined for the crop of the Pittsburgh seam on Map II, or on the average about 100 feet higher in the hills than the latter coal. It attains its best development in the State in Monongalia and Marion counties, often reaching a thickness of over 6 feet; but in Taylor it has thinned away entirely, frequently being represented by only a few inches of black

6. Bull. 65, U. S. Geol. Sur., p. 60; 1891.

slate. Its thickness and relative position in the rock column are exhibited in the general sections for St. Cloud, Mooresville, Behler, Randall and Cassville in Monongalia; and for Glover Gap, Mannington, Farmington, Downs, Worthington, Monongah N W, Ices Run-Fairmont and Monongah S E in Marion. The logs of the several diamond drill holes, published on preceding pages of this chapter give valuable data concerning this seam.

The following is a general section of the bed when possessing its normal thickness of five to six feet:

|                                       |    |    |       |
|---------------------------------------|----|----|-------|
| Coal, upper bench.....                | 3' | 0" |       |
| Slate, shale or limestone, 1" to..... | 0  | 4  |       |
| Coal, lower bench.....                | 2  | 8  | 6' 0" |

Sometimes both benches are again subdivided by one or more thin slates. Thin layers of limestones frequently appear within the body of the bed, revealing the peculiar conditions under which the coal was deposited.

The thickness, character, composition and calorific value of this seam in country banks as well as at commercial mines, will be discussed in detail in a subsequent chapter on the coal resources of the area, along with an estimate of the probable minable area of the bed by magisterial districts.

### The Lower Sewickley Sandstone.

Immediately under the Sewickley coal there often occurs a buff, fine grained and massive sandstone, 15 to 30 feet in thickness, that has been named the **Lower Sewickley**<sup>7</sup> from its association with the coal. Its thickness and relative position in the measures are exhibited in the sections for Monongah N W, Tyrconnell and Plummer Knob, and in the record of the Annabelle shaft. It generally forms a bluff around the hillsides immediately below the crop of the Sewickley coal. No quarries were observed on this ledge.

7. Ray V. Hennen, Doddridge-Harrison Rept., W. Va. Geol. Sur., p. 201; 1912.

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Photo by Ray Bricker.  
**PLATE XVII.**—Sewickley Coal, Markley mine, ½ mile east of Osgood, Monongalia County.



**The Sewickley Limestone.**

The **Sewickley limestone** of J. J. Stevenson comes in the 60-foot interval separating the Sewickley and Redstone coals. It is a hard gray limestone of brackish or fresh water origin, 25 to 50 feet thick including its shale layers. Its thickness and relative position to other formations are exhibited in the general sections for Mooresville and Behler in Monongalia; for Fairview, Downs, Worthington and Monongah N W in Marion; and for Meadland in Taylor. Its crop in the three counties follows closely the area outlined above for the Sewickley coal.

Reger collected a sample for analysis and measured the following section at the exposure of this ledge along the Baltimore & Ohio Railroad grade, 0.2 mile west of Montana Mines, Marion county:

|  | Feet.        | Inches. |
|--|--------------|---------|
| 1. Coal, good.....4' 2"                    |              |         |
| 2. Slate, gray.....0 2                     |              |         |
| 3. Coal, good, columnar .....1 4           | Sewickley    |         |
| 4. Shale, gray.....0 6                     | coal .....   | 7 0     |
| 5. Coal .....0 10                          |              |         |
| 6. Limestone, gray and hard .....6' 0"     |              |         |
| 7. Shale, gray and limy .....1 0           |              |         |
| 8. Limestone, silicious soft .....3 0      |              |         |
| 9. Shale, gray, with limestone nuggets.7 0 | Sewickley    |         |
| 10. Slate, with streaks of coal .....0 6   | limestone .. | 30 0    |
| 11. Slate, black.....0 6                   |              |         |
| 12. Shale gray.....1 0                     |              |         |
| 13. Limestone, massive, white .....4 0     |              |         |
| 14. Shale, gray.....1 0                    |              |         |
| 15. Limestone, yellow.6 0                  |              |         |

(Elevation of base of section, 877' A. T., spirit level).

The composition of the sample from Nos. 6, 13 and 15 only of section, is reported by Messrs. Hite and Krak as follows:



|   | Per cent.     |
|---|---------------|
| Silica (Si O <sub>2</sub> ).....                      | 11.02         |
| Ferric Iron (Fe <sub>2</sub> O <sub>3</sub> ).....    | 5.64          |
| Alumina (Al <sub>2</sub> O <sub>3</sub> ).....        | 5.55          |
| Calcium Carbonate (Ca CO <sub>3</sub> ).....          | 53.09         |
| Magnesium Carbonate (Mg CO <sub>3</sub> ).....        | 1.63          |
| Phosphoric Acid (P <sub>2</sub> O <sub>5</sub> )..... | 0.23          |
| Loss on ignition and undetermined.....                | 22.84         |
| <b>Total .....</b>                                    | <b>100.00</b> |

The results show the sample too high in sandy and clayey matter—silica and alumina—for the manufacture of quick or hot limes, but it would burn into a fair agricultural lime and would be adapted to the manufacture of natural cement.

This limestone has been largely replaced by sandy beds and shales in Taylor county. Near the extreme southwest corner of Flemington district, Reger collected a sample of the ledge for analysis and measured the following section at its exposure along the hill road on the head of Bartlett run, 0.2 mile northwest of the common corner to Taylor, Barbour and Harrison counties:

|   | Thickness. | Total. |
|---|------------|--------|
|   | Feet.      | Feet.  |
| Sandstone shaly, Upper Sewickley.....         | 22         | 22     |
| Slate, black, 1", Sewickley coal horizon..... | 0          | 22     |
| Shale, yellow.....                            | 1          | 23     |
| Limestone, yellow, good, Sewickley.....       | 1          | 24     |
| Limestone, yellow and brecciated.....         | 12         | 36     |
| Sandstone, shaly, Lower Sewickley.....        | 24         | 60     |
| Shale, sandy.....                             | 6          | 66     |
| Concealed .....                               | 25         | 91     |
| Sandstone, shaly.....                         | 2          | 93     |
| Shale, dark.....                              | 8          | 101    |
| Slate, black.....                             | 3          | 104    |
| Coal, Pittsburgh (1255' B-A. T.).....         | 7          | 111    |

The composition of the sample is reported by Messrs. Hite and Krak as follows under Lab. No. 564 H:

|   | Per cent.    |
|---|--------------|
| Silica (Si O <sub>2</sub> ).....                      | 21.35        |
| Ferric Iron (Fe <sub>2</sub> O <sub>3</sub> ).....    | 3.69         |
| Alumina Al <sub>2</sub> O <sub>3</sub> ).....         | 4.75         |
| Calcium Carbonate (Ca CO <sub>3</sub> ).....          | 65.65        |
| Magnesium Carbonate (Mg CO <sub>3</sub> ).....        | 2.27         |
| Phosphoric Acid (P <sub>2</sub> O <sub>5</sub> )..... | 0.20         |
| Loss on ignition.....                                 | 1.27         |
| <b>Total .....</b>                                    | <b>99.18</b> |

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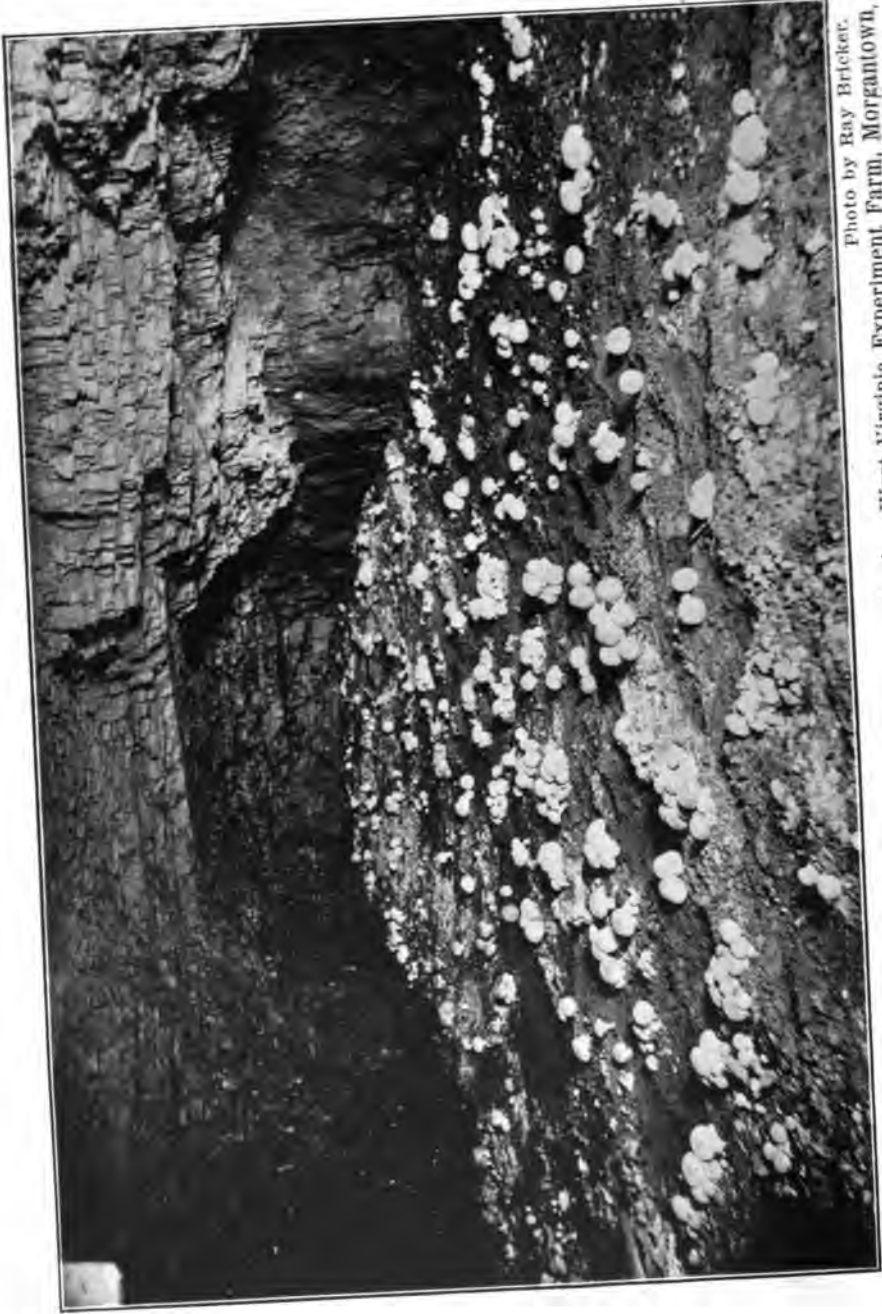


Photo by Ray Brickett.  
PLATE XVIII.—Mushroom bed in abandoned Pittsburgh coal mine, West Virginia Experiment Farm, Morgantown,

The results reveal a limestone adapted to the manufacture of agricultural lime and road material.

This limestone not only adds greatly to the fertility of the soil in the area, but it should furnish an abundance of road metal in Cass and Grant districts, Monongalia; and in Paw-paw, Fairmont, Lincoln and Grant districts, Marion county.

### The Redstone Coal.

The **Redstone** coal of H. D. Rogers, so designated by the latter from a stream of that name in Fayette county, Pa., belongs 50 to 70 feet below the Sewickley coal and 20 to 40 feet above the Pittsburgh bed. In this area its crop should follow closely the region outlined for the Pittsburgh coal on Map II. Its thickness and relative position to other formations of the Monongahela series are exhibited in the general sections for Mooresville, Behler and Randall in Monongalia; for Ices Run-Fairmont in Marion; and for Webster in Taylor county. Also in the logs published on preceding pages for the following diamond drill borings:

| Map No. | Name of Boring           | Location                       | Page |
|---------|--------------------------|--------------------------------|------|
| 643     | Mary Hawkins No. 13..... | 0.6 mile SE of Sturms Mill.... | 223  |
| 653     | Wm. F. Sandy No. 12..... | 0.5 mile W of Hutchinson....   | 226  |
| 672     | Shore No. 7.....         | 1 mile SW of Barrackville....  | 140  |

The coal appears to attain minable thickness in a very small portion of the three counties as revealed from crop and the logs of many oil, gas and coal test borings; viz., in the eastern half of Cass and the northeastern corner of Grant district, Monongalia county. Here it sometimes reaches a thickness of 4 to 6 feet. It has been mined on the waters of Scott and Robinson runs by farmers for domestic fuel, giving excellent satisfaction and comparing favorably with the Pittsburgh bed below. All the openings visited had fallen shut so that it was not possible to get a sample for analysis away from its crop; however, Reger collected a sample and measured the following section where the coal had been faced up in a prospect opening on the south hillside of Scott run, one-fourth mile southwest of Randall:

**A. H. Tait Prospect, Redstone Coal—No. 15B on Map II.**

|                          | Feet. | Inches. |
|--------------------------|-------|---------|
| 1. Slate dark.....       |       |         |
| 2. Coal, good.....3' 1½" |       |         |
| 3. Slate, black.....0 0¼ |       |         |
| 4. Coal, good.....2 10½  | 6     | 0¼      |

(Elevation, 970' A. T., aneroid).

"Face of coal cleaned off before taking sample, but some streaks of mud were present in coal owing to its lack of cover."

The composition of the sample from Nos. 2, 3 and 4 of section, as reported by Messrs. Hite and Krak, is given under No. 15B (Laboratory No. 815H) in the table of coal analyses.

One mile and a quarter southwestward this coal was once mined near the level of a branch of Dents run, on the Martin farm, opposite the residence of S. Z. T. Martin. The opening had fallen shut, but the coal is reported 4 to 5 feet thick and of fine quality.

Slightly over two miles southwestward the Redstone coal is reported absent in the Frank Brand coal test boring (315), 1 mile westward from Laurel Point.

The probable minable area of the bed will be discussed in detail in a subsequent chapter.

**The Redstone Limestone.**

The 20 to 40 feet of interval between the Redstone and Pittsburgh coals generally carries a calcareous stratum, 5 to 15 feet in thickness, that has been named by Messrs. Platt the **Redstone limestone** from its association with the overlying coal. Its crop in the three counties follows closely the area outlined for the crop of the Pittsburgh coal on Map II. It is dark gray in color on fresh fracture, but weathers to a yellowish gray. The limestone is of brackish or fresh water origin as revealed by the fresh water fossils therein. Its thickness and relative position in the rock column are exhibited in the general sections for Mooresville, Behler and Randall in Monongalia; for Ices Run-Fairmont and Monongah S E in Marion; and for Webster in Taylor county.

The following interesting data concerning the thickness,

character, composition and uses of the Redstone limestone at its crop on Scott run, Cass district, Monongalia county, near the old Tait mine in the Pittsburgh coal, along with the Uniontown and Sewickley limestone cropping above, is taken from pages 529 and 530 of Vol. III of the State Survey reports:

"The Pittsburgh coal is mined a short distance up the creek and underlies nearly all this region. Ten to twelve feet above the coal is the Redstone limestone 18 feet in thickness, with the Redstone coal above and 75 to 100 feet higher is a series of limestone layers separated by shales about 100 feet in thickness, known as the Uniontown limestone.

"Over the Redstone coal is a fine shale 15 to 20 feet in thickness, and then 6 feet of limestone. In this area are shales, limestone and coal. While the Redstone limestone is not very thick (18 feet) it outcrops around the hills over a large acreage, so that the quantity would be large, and followed around these hills the cover would not be too heavy for profitable quarrying.

"The chemical composition of these limestones is shown by the following analyses:

|                           | No. 122      | No. 125       | No. 126       |
|---------------------------|--------------|---------------|---------------|
| Lime carbonate.....       | 79.63        | 86.70         | 83.52         |
| Magnesium carbonate ..... | 1.44         | 5.32          | 3.78          |
| Silica .....              | 12.21        | 5.96          | 10.54         |
| Alumina .....             | 2.87         | 1.01          | 0.75          |
| Iron oxide.....           | 2.36         | 1.27          | 2.06          |
| Titanium .....            | 0.15         | 0.07          | 0.05          |
| <b>Totals .....</b>       | <b>98.66</b> | <b>100.33</b> | <b>100.70</b> |

"No. 122 is the Redstone limestone.

"No. 125 is near the top of the Uniontown limestone.

"No. 126 is the 6 to 8 foot limestone (Sewickley) above Redstone coal.

"A mill could be built near the river and the cement loaded directly into boats or an overhead cable carry the cement across the river to the Baltimore & Ohio Railroad.

"For fuel, the Pittsburgh coal could be mined by drift or shaft over the whole area, the other coals would be available as fuel for power."

It might be added that since the above was written by G. P. Grimsley in 1906 the Buckhannon & Northern Branch of the Pittsburgh & Lake Erie Railroad has been completed on the west side of the river, thus furnishing additional transportation facilities.

In Taylor county this limestone does not appear so thick as in Monongalia and Marion. In Courthouse district, slightly over a mile south of Webster, Reger collected a sample of this ledge for analysis and measured the following hand-leveled section:

|  | Thickness. Total. |       |
|--|-------------------|-------|
|  | Feet.             | Feet. |
| 1. Coal streak, Redstone.....            | 0                 | 0     |
| 2. Limestone, yellow, Redstone.....      | 1                 | 1     |
| 3. Concealed .....                       | 23                | 24    |
| 4. Slate .....                           | 4                 | 28    |
| 5. Coal, Pittsburgh (1435' L-A. T.)..... | 9                 | 37    |

The composition of the sample from No. 2 of section is reported by Messrs. Hite and Krak as follows:

|   | Per cent.    |
|---|--------------|
| Silica ( $\text{Si O}_2$ ).....                 | 9.15         |
| Ferric Iron ( $\text{Fe}_2\text{O}_3$ ).....    | 3.53         |
| Alumina ( $\text{Al}_2\text{O}_3$ ).....        | 1.35         |
| Calcium Carbonate ( $\text{Ca CO}_3$ ).....     | 71.73        |
| Magnesium Carbonate ( $\text{Mg CO}_3$ ).....   | 11.51        |
| Phosphoric Acid ( $\text{P}_2\text{O}_5$ )..... | 0.14         |
| Loss on ignition.....                           | 2.20         |
| <b>Total .....</b>                              | <b>99.61</b> |

The results reveal a magnesian limestone adapted to the manufacture of natural cement, but too high in sandy and clayey matter for the lime of commerce.

This limestone adds greatly to the fertility of the soil wherever it crops above drainage and it should furnish an abundant supply of road metal in Cass and Grant districts, Monongalia; in Pawpaw, Fairmont, Lincoln and Grant districts, Marion; and in Flemington and Courthouse districts, Taylor county.

### The Upper Pittsburgh Sandstone.

The **Upper Pittsburgh sandstone**, coming immediately over the Pittsburgh coal, was so named by H. D. Rogers from its association with the latter bed. Its horizon should crop over about the same area as that outlined for the Pittsburgh coal on Map II. It is an old shore deposit and attains its best development on the east side of the Monongahela river, being largely replaced by limestones on the west side of the latter stream. Its thickness and relative position to other formations are exhibited in the general sections for Morgan Run, Easton, Morgantown and Beechwood in Monongalia; and for Farmington, Ices Run-Fairmont and Monongah S. E in Marion county. Also in the log of the Jamison No. 7 shaft, page 230.





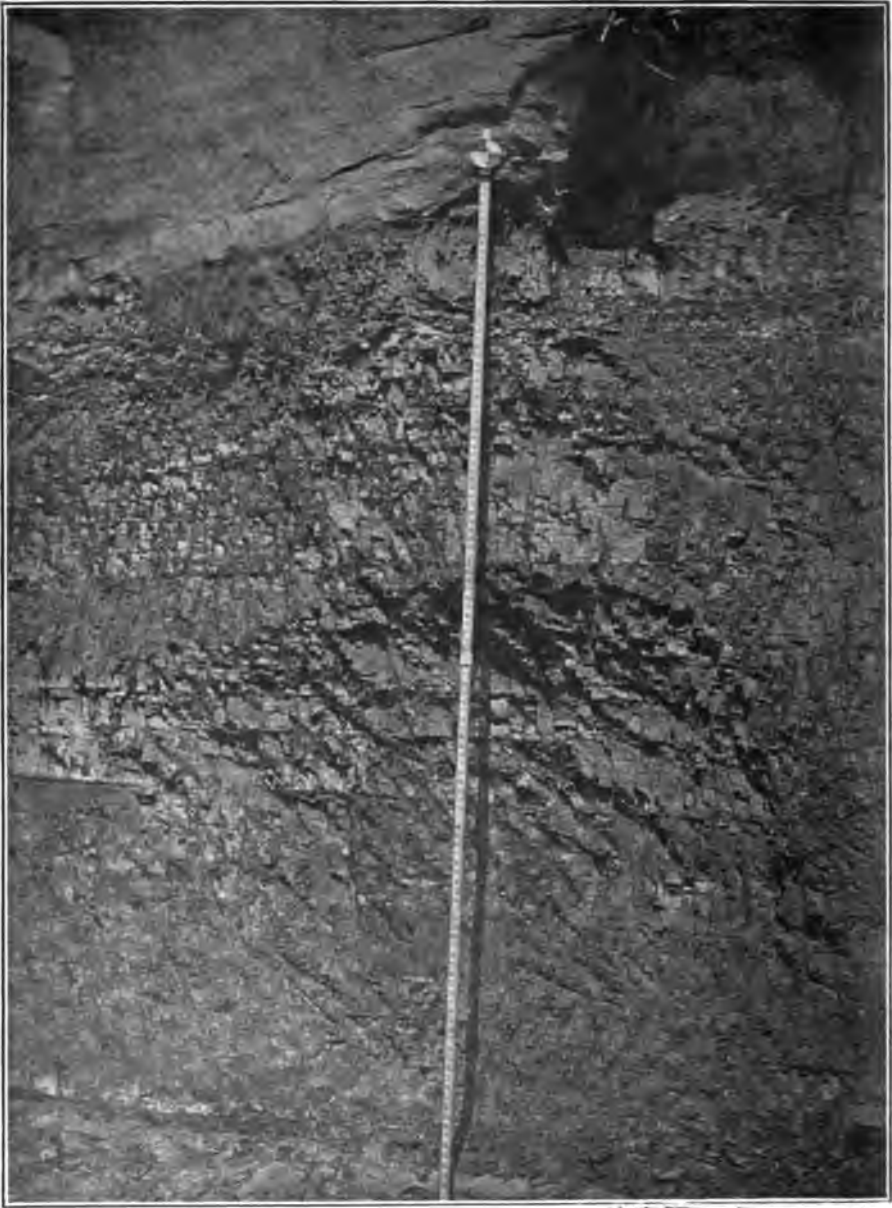


Photo by Ray Bricker.

**PLATE XIX.**—Pittsburgh Coal exposure in Monongahela River hill  
opposite Round Bottom, Monongalia County.

In eastern Monongalia and Marion, where it is well developed, it is usually a massive, coarse, gray, arenaceous stratum, containing much feldspathic material, and easily disintegrating into coarse sand where exposed to the atmosphere. It has been quarried frequently for building purposes in the Fairmont region of Marion county, but its easily weathering properties render it unsatisfactory for exposed work. It is this stratum that is quarried  $\frac{1}{4}$  mile northwest of the Fairmont Fairground at an elevation of 1070' A.T., aneroid, where the following section was measured by Reger:

|                         | Feet. |
|-------------------------|-------|
| Sandstone, shaly.....   | 7     |
| Sandstone, massive..... | 16    |
| Shale .....             | 4     |
| Coal ,Pittsburgh.....   | 8     |

It is also this sandstone that is quarried along the hill road, 0.9 mile southeast of the Baltimore & Ohio Railroad station at Fairmont, where it is 25 feet thick, massive, coarse, gray and soft, coming directly over the Pittsburgh coal.

### The Pittsburgh Coal.

The basal formation of the Monongahela series is the **Pittsburgh coal bed**, so named by J. P. Lesley in 1856 from the city of Pittsburgh, Pa., where it crops high up in the river hills. I. C. White gives an interesting account of this great coal seam and its influence on the industrial growth of northern West Virginia and the city of Pittsburgh, on page 164 of Vol. II of the State Survey reports.

In the western portions of Monongalia and Marion counties this coal lies from 300 to 800 feet below drainage, but in the districts fronting on the Monongahela and West Fork rivers, it comes to the surface. A small area of this bed is caught in the Ligonier Basin, southwest from Pruntytown in Taylor county. The detailed crop of the coal is shown on Map II.

As mentioned on preceding pages, this bed is largely used as a key rock by oil and gas well drillers to determine the position of the oil and gas bearing sands. Map II exhib-

its by means of contour lines, printed in green, the elevation above mean tide of the top of the horizon of this coal in every portion of the area, even where the seam has been entirely eroded. This map also shows the accurate location of the oil and gas wells, dry holes and coal test borings, a large number of which have been given the same serial number for reference purposes both on the map and in the text of this report. The reader is referred to these numbered wells in the table for each county given on subsequent pages for a large fund of information concerning Pittsburgh coal.

In every portion of the area, wherever not removed by erosion, this bed appears to attain minable thickness and regularity.

J. J. Stevenson first described the detailed structure of the coal in Report K of the Second Geological Survey of Pa., where he shows that a series of thin parting clays and slates subdivide the seam into several distinct portions as follows:

- |                     |                 |
|---------------------|-----------------|
| 1. Roof coals.      | 6. Parting.     |
| 2. Over clay.       | 7. Brick coal.  |
| 3. Breast coal.     | 8. Parting.     |
| 4. Parting.         | 9. Bottom coal. |
| 5. Bearing-in coal. |                 |

A description of the character and thickness of these separate parts is given on pages 166-172 of Vol. II of the State Survey reports by I. C. White.

At present there are 55 to 60 commercial mines in the Pittsburgh coal in the three counties. With the exception of seven shaft operations in Marion, all are driven directly on the crop of the coal or by slope. The following is a general type section of the coal as exhibited at these mines:

|                                       | Feet. | Inches. |
|---------------------------------------|-------|---------|
| 1. Draw slate.....                    |       |         |
| 2. Breast coal { top coal bony..1' 0" |       |         |
| { coal .....2 6                       | 3     | 6       |
| 3. Bands { bone .....0' 0¾"           |       |         |
| { coal .....0 6                       |       |         |
| { bone .....0 0¾                      | 0     | 7½      |
| 4. Bottom coal .....                  | 4     | 6       |
| Total .....                           | 8     | 7½      |

The "roof coals" of Stevenson are not always present, but the other divisions are generally represented.

The thickness, character, composition, and calorific value of the coal at the several commercial mines as well as some local country banks, will be discussed fully in a subsequent chapter, along with an estimate of the probable available area and tonnage of the bed by magisterial districts.

# CHAPTER VII.

## STRATIGRAPHY—CONEMAUGH SERIES.

The Conemaugh series is limited to that division of the rock column that begins at base with the top of the Upper Freeport coal and extends up to the base of the Pittsburgh coal. I. C. White gives an interesting account of this series in West Virginia on pages 225-226 of Vol. II of the State Survey reports.

Map II shows the detailed crop of these rocks, and a glance at the same will show that they rank next to the Dunkard in area exposed. The thickness ranges from 550 feet in western Monongalia to 600 feet along the Monongahela river in the latter county.

### SECTIONS.

The following general section of the Conemaugh in West Virginia with some slight modifications is as published by the writer on pages 220-221 of the Doddridge-Harrison Report:

#### General Section of the Conemaugh Series in West Virginia.

|   | Thickness. | Total. |     |
|---|------------|--------|-----|
|   | Feet.      | Feet.  |     |
| Fire clay and shale.....                                    | 5          | 5      |     |
| Sandstone massive, Lower Pittsburgh.....                    | 35         | 40     |     |
| Shale, gray.....  | 3          | 43     |     |
| Limestone, Upper Pittsburgh.....                            | 4          | 47     |     |
| Coal, Little Pittsburgh.....                                | 1          | 48     | 48' |
| Fire clay and gray shale.....                               | 7          | 55     |     |
| Limestone, Lower Pittsburgh.....                            | 10         | 65     |     |
| Shale, sandy and red.....                                   | 40         | 105    |     |
| Sandstone, massive, brown, pebbly, Connells-<br>ville ..... | 30         | 135    |     |
| Coal, Little Clarksburg.....                                | 1          | 136    | 88' |
| Fire clay shale, Clarksburg.....                            | 5          | 141    |     |

|   | Thickness.<br>Feet. | Total.<br>Feet. |      |
|---|---------------------|-----------------|------|
| Sandstone, massive, mottled with peroxide of iron, lenticular, quarried at Morgantown, Lower Connellsville..... | 20                  | 161             |      |
| Limestone, gray and hard, Clarksburg, 5' to   | 15                  | 176             |      |
| Shale, sandy and red, Clarksburg Reds.....  | 37                  | 213             |      |
| Sandstone, massive, Morgantown.....   | 40                  | 253             |      |
| Coal Elk Lick.....  | 2                   | 255             | 119' |
| Fire clay and shale.....  | 9                   | 264             |      |
| Lime, dark gray, Elk Lick.....  | 5                   | 269             |      |
| Coal, West Milford (2") to.....   | 1                   | 270             |      |
| Shale, sandy and red, Birmingham.....   | 10                  | 280             |      |
| Sandstone, massive, pebbly, lenticular, Graf-ton .....  | 20                  | 300             |      |
| Limestone, marine fossils, Upper Ames.....  | 4                   | 304             |      |
| Shale, dark green, marine fossils, Ames.....  | 15                  | 319             |      |
| Limestone, marine fossils, Lower Ames.....  | 3                   | 322             |      |
| Shale, dark .....   | 6                   | 328             |      |
| Coal, Harlem .....  | 2                   | 330             | 75'  |
| Fire clay and red shale.....  | 10                  | 340             |      |
| Limestone, gray, Ewing.....   | 5                   | 345             |      |
| Red shale, "Pittsburgh Reds".....   | 40                  | 385             |      |
| Sandstone, massive, Saltsburg.....  | 30                  | 415             |      |
| Coal, Bakerstown .....  | 2                   | 417             | 87'  |
| Fire clay shale.....  | 5                   | 422             |      |
| Limestone, marine fossils, Pine Creek.....  | 1                   | 423             |      |
| Shale, 5' to.....   | 21                  | 444             |      |
| Sandstone, massive, gray and white, pebbly Buffalo .....  | 60                  | 504             |      |
| Limestone, marine fossils, Brush Creek, 1' to   | 5                   | 509             |      |
| Shale, black, marine and plant fossils, Brush Creek, 5' to.....   | 10                  | 519             |      |
| Coal, Brush Creek.....  | 1                   | 520             | 103' |
| Fire clay shale with layers of ferriferous limestone, Brush Creek.....  | 4                   | 524             |      |
| Sandstone, massive, Upper Mahoning.....   | 15                  | 549             |      |
| Coal, not persistent, Mahoning, 0' to.....  | 1                   | 550             | 30'  |
| Fire clay, good, not persistent, Thornton, 0' to .....  | 5                   | 555             |      |
| Sandstone, Lower Mahoning.....  | 40                  | 595             |      |
| Shale, dark sandy, plant fossils, Uffington..   | 5                   | 600             | 50'  |
| Coal, Upper Freeport.   |                     |                 |      |

Several sections, published in Chapter IV, exhibit the succession and character of the strata of the Conemaugh series in the area, and five other widely separated sections as exposed at crop will now be given:

MONONGALIA COUNTY.—The following section was measured in the northwest portion of Morgan district with hand-level southward down the river hill from the O. H. Dille sandstone quarry in the Lower Connellsville ledge and connected with the top of the Jos. Krepps No. 1 well (320A) opposite Mona (Granville):

## Section 0.8 Mile E of Mona, Conemaugh Series.

|  | Thickness. Total. |       |      |
|--|-------------------|-------|------|
|  | Feet.             | Feet. |      |
| Shale, sandy.....  | 2.7               | 2.7   |      |
| Shale, bituminous (Little Clarksburg coal horizon) .....   | 0.3               | 3     | 3'   |
| Fire clay shale.....   | 1                 | 4     |      |
| Sandstone, shaly and green.....  | 6                 | 10    |      |
| Sandstone, massive, coarse, brown, mottled heavily in upper portion with peroxide of iron, quarry ledge, Lower Connellsville.... | 11                | 21    | 18'  |
| Limestone, gray and hard, silicious, Clarksburg .....  | 1.5               | 22.5  |      |
| Shale, variegated, with layers of limestone  | 20                | 42.5  |      |
| Limestone, dark gray and hard, nodular....   | 2                 | 44.5  |      |
| Shale, limy and variegated, with concretions of ferriferous limestone at bottom.....   | 25                | 69.5  |      |
| Sandstone, shaly, Morgantown, and concealed  | 18                | 87.5  |      |
| Coal (20") Elk Lick.....   | 1.5               | 89    | 68'  |
| Concealed and limestone, Lower Ames.....   | 85                | 174   |      |
| Concealed to Jos. Krepps No. 1 well (320 A)  | 64                | 238   | 149' |

This is an important section in that—in connection with the one for Morgantown in Chapter IV—it shows the quarry rock belonging between the Little Clarksburg coal horizon and the Clarksburg limestone, 20 feet below the true Connellsville sandstone; hence, it has been designated by the writer the **Lower Connellsville**.

The following section of the upper portion of the Conemaugh is obtained in the northern edge of Union district, one-third mile southward from Cheat Haven, by combining a spirit level section measured down the east hillside of Cheat to the State Line Dam, with the log of a diamond drill boring (328) kindly furnished by the Mt. Park Land Co.:

## Cheat Haven Dam Section.—Conemaugh Series.

|                              | Thickness | Total,  | Tidal              |
|------------------------------|-----------|---------|--------------------|
|                              | Ft. In.   | Ft. In. | Elevation of base. |
| Coal, Pittsburgh.....        | 8 0       | 8 0     | 1062.0             |
| Conemaugh Series:            |           |         |                    |
| Unrecorded .....             | 187 0     | 195 0   | 875.0              |
| Shale, broken and sandy..... | 27 0      | 222 0   | 848.0              |
| Shale, sandy.....            | 2 6       | 224 6   | 845.5              |
| Shale .....                  | 4 6       | 229 0   | 841.0              |
| Fire clay .....              | 1 0       | 230 0   | 840.0              |
| Slate .....                  | 1 0       | 231 0   | 839.0              |

|   | Thickness. |     | Total. | Tidal<br>Eleva-<br>tion<br>of base. |       |     |       |   |   |                    |
|---|------------|-----|--------|-------------------------------------|-------|-----|-------|---|---|--------------------|
|   | Ft.        | In. |        |                                     | Ft.   | In. |       |   |   |                    |
| Coal, Elk Lick.....   | 1          | 0   | 232    | 0                                   | 838.0 |     |       |   |   |                    |
| Limestone, Elk Lick.....  | 6          | 0   | 238    | 0                                   | 832.0 |     |       |   |   |                    |
| Fire clay.....  | 11         | 0   | 249    | 0                                   | 821.0 |     |       |   |   |                    |
| Sandstone .....   | 2          | 0   | 251    | 0                                   | 819.0 |     |       |   |   |                    |
| Shale, hard, sandy.....   | 6          | 6   | 257    | 6                                   | 812.5 |     |       |   |   |                    |
| Shale .....   | 5          | 0   | 262    | 6                                   | 807.5 |     |       |   |   |                    |
| Concealed, surface debris.....  | 11         | 0   | 273    | 6                                   | 796.5 |     |       |   |   |                    |
| Shale, fire clay and loam.....  | 5          | 3   | 278    | 9                                   | 791.2 |     |       |   |   |                    |
| Shale, or hard yellow fire clay....                                     | 3          | 4   | 282    | 1                                   | 787.9 |     |       |   |   |                    |
| <b>Bore Hole No. 1 Record</b>   |            |     |        |                                     |       |     |       |   |   |                    |
| Gravel wash from top.....   | 15         | 6   | 297    | 7                                   | 772.4 |     |       |   |   |                    |
| Fire clay wash.....   | 2          | 6   | 300    | 1                                   | 770.2 |     |       |   |   |                    |
| Shale, dark gray, medium hard...  | 10         | 4   | 310    | 5                                   | 759.9 |     |       |   |   |                    |
| Shale, dark gray,<br>marine fossils..3' 2"                              | }          |     | 6      | 8                                   | 317   | 1   | 753.2 |   |   |                    |
| Limestone, dark<br>gray .....   |            |     |        |                                     |       |     |       | 0 | 6 | (Lower<br>Ames)... |
| Shale, black, ma-<br>rine fossils.....                                  |            |     |        |                                     |       |     |       | 3 | 0 |                    |
| Coal, Harlem.....   | 0          | 4   | 317    | 5                                   | 752.9 |     |       |   |   |                    |
| Fire clay shale, gray.....  | 10         | 0   | 327    | 5                                   | 742.9 |     |       |   |   |                    |
| Shale, red and variegated, Pitts-<br>burgh Reds .....                   | 18         | 6   | 345    | 11                                  | 724.4 |     |       |   |   |                    |
| Shale, gray.....  | 2          | 6   | 348    | 5                                   | 721.9 |     |       |   |   |                    |
| Shale, greenish gray, silicious and<br>hard .....                       | 5          | 0   | 353    | 5                                   | 716.9 |     |       |   |   |                    |
| Sandstone, fine grained, micaceous,<br>light gray and hard, Saltsburg.. | 9          | 3   | 362    | 8                                   | 707.6 |     |       |   |   |                    |
| Shale, sandy and limy, greenish..                                       | 4          | 0   | 366    | 8                                   | 703.6 |     |       |   |   |                    |
| Shale, variegated, with tinge of<br>red to bottom of hole.....          | 15         | 9   | 382    | 5                                   | 687.9 |     |       |   |   |                    |

The following section was measured with hand-level by Reger along the southeast border of Grant district south-eastward down the river hill from the crop of the Pittsburgh coal to the Monongahela river opposite Round Bottom:

#### Round Bottom Section, Conemaugh Series.

|   | Thickness. |       | Total. |
|---|------------|-------|--------|
|   | Feet.      | Feet. |        |
| Shale, gray.....                              | 2          |       | 2      |
| Concealed .....                               | 37         |       | 39     |
| Shale, black, streak.....                     | 0          |       | 39     |
| Limestone, shaly, Lower Pittsburgh.....       | 7          |       | 46     |
| Sandstone, light brown, fine grained, hard... | 15         |       | 61     |
| Concealed .....                               | 9          |       | 70     |
| Sandstone, brown, flaggy, fine, Connellsville | 22         |       | 92     |
| Concealed .....                               | 18         |       | 110    |
| Sandstone, massive.....                       | 4          |       | 114    |
| Concealed and shale, yellow.....              | 16         |       | 130    |
| Concealed .....                               | 33         |       | 163    |



|  | Thickness. |       | Total. |
|--|------------|-------|--------|
|  | Feet.      | Feet. |        |
| Coal, very slaty, Elk Lick.....                                      | 1          | 164   | 164'   |
| Concealed .....  | 35         | 199   |        |
| Sandstone, hard, brown, massive, pebbly,<br>Grafton .....            | 28         | 227   |        |
| Concealed .....  | 5          | 232   |        |
| Sandstone, shaly.....  | 2          | 234   |        |
| Shale, green.....  | 20         | 254   |        |
| Limestone, shaly, fossiliferous, Ames.....                           | 5          | 259   |        |
| Coal, Harlem (855' L-A. T.).....                                     | 1          | 260   | 96'    |
| Shale, red, Pittsburgh, and concealed to<br>river (Pool No. 11)..... | 38         | 298   | 38'    |

In the above section intervals and thicknesses of formations above the Elk Lick coal are much less than they should be owing to the rapid rise of the strata in the direction of measurement.

MARION COUNTY.—The following partial section of these beds was measured with hand-level by Reger south-eastward from the Pittsburgh coal to the river, 0.2 mile north-east of the Baltimore & Ohio R. R. station at Fairmont:

#### Fairmont Section, Conemaugh Series.

|  | Thickness. |       | Total. |
|--|------------|-------|--------|
|  | Feet.      | Feet. |        |
| Shale, very silicious, with iron ore nuggets..               | 22         | 22    |        |
| Sandstone, massive, white, soft, Lower Pitts-<br>burgh ..... | 16         | 38    |        |
| Shale, gray, limy.....                                       | 9          | 47    |        |
| Coal, slaty, Little Pittsburgh.....                          | 0.5        | 47.5  |        |
| Shale, limy, gray.....                                       | 23.5       | 71    |        |
| Shale, dark.....   | 5          | 76    |        |
| Limestone, massive, Lower Pittsburgh.....                    | 6          | 81    |        |
| Concealed to river.....                                      | 22         | 103   |        |

TAYLOR COUNTY.—In the western portion of Booths Creek district the following section was measured with aneroid southeastward along the hill road to Carder run at Hepzibah:

#### Hepzibah Section, Conemaugh Series.

|   | Thickness. |       | Total. |
|---|------------|-------|--------|
|   | Feet.      | Feet. |        |
| Sandstone, massive, coarse, pebbly, Grafton,<br>from summit of hill road..... | 25         | 25    |        |
| Shale, dark green, marine fossils, Ames.....                                  | 9.5        | 34.5  |        |
| Coal .....0' 9" } Harlem coal. 1.5 36 36'                                     |            |       |        |
| Slate, gray.....0 1 } (1320' B-A. T.)   |            |       |        |
| Coal .....0 8 }   |            |       |        |

|  | Thickness.<br>Feet. In. | Total.<br>Feet. In. |      |
|--|-------------------------|---------------------|------|
| Shale, red, Pittsburgh.....              | 20                      | 56                  |      |
| Shale, buff, sandy, yellowish.....       | 10                      | 66                  |      |
| Sandstone, shaly.....                    | 5                       | 71                  |      |
| Concealed and red shale.....             | 15                      | 86                  |      |
| Shale, sandy.....                        | 10                      | 96                  |      |
| Concealed.....                           | 5                       | 101                 | 65'  |
| Fire clay shale.....                     | 5                       | 106                 |      |
| Shale, buff, sandy.....                  | 5                       | 111                 |      |
| Red shale.....                           | 20                      | 131                 |      |
| Concealed.....                           | 20                      | 151                 |      |
| Black slaty blossom.....                 | 0                       | 151                 |      |
| Concealed to Carder run at Hepzibah..... | 50                      | 201                 | 100' |

The following section was measured with aneroid in the central portion of Knottsville district westward along the hill road to Knottsville:

#### Knottsville Section, Conemaugh Series.

|  | Thickness.<br>Feet. | Total.<br>Feet. |
|--|---------------------|-----------------|
| Sandstone, massive, Connellsville.....     | 35                  | 35              |
| Concealed.....                             | 10                  | 45              |
| Shale, buff and sandy.....                 | 10                  | 55              |
| Concealed.....                             | 25                  | 80              |
| Shale, buff.....                           | 20                  | 100             |
| Concealed.....                             | 20                  | 120             |
| Shale, yellowish.....                      | 15                  | 135             |
| Shale, red.....                            | 30                  | 165             |
| Shale, buff and sandy.....                 | 15                  | 180             |
| Concealed to cross-roads, Knottsville..... | 35                  | 215             |

(Base of section, 1484' A. T., spirit level).

The base of the section comes only a few feet—5' to 15'—above the Elk Lick coal the blossom of which shows along the highway, 0.4 mile southeast of the town. Owing to the rapid dip of the strata in the direction the section was measured, intervals are greater than they should be.

### DESCRIPTION OF CONEMAUGH FORMATIONS.

#### The Lower Pittsburgh Sandstone.

The highest formation yet described in the Conemaugh measures is the **Lower Pittsburgh sandstone**, belonging at 5 to 10 feet below the Pittsburgh coal. When normal it is a

massive bluish gray rock, micaceous and medium grained, ranging in thickness from 5 to 25 feet. Its thickness and relative position to other formations are exhibited in the sections for Randall, VanVoorhis and Morgantown in Monongalia; for Fairmont in Marion; and for Flemington and Thornton in Taylor.

It is this stratum that is quarried on the J. W. Holland farm in the northeast corner of Grant district, Monongalia, 0.4 mile northeast of the J. W. Holland No. 1 well (317), where the following section is exposed:

|  | Ft. | In. |
|--|-----|-----|
| Sandstone, shaly.....  | 6   | 0   |
| Sandstone, hard, bluish gray, micaceous and medium grained, quarry rock..... | 11  | 0   |
| Concealed .....  |     |     |
| (Elevation of sandstone, 960' B-A, T.)                                       |     |     |

The face of the quarry is 11 feet high, 75 to 100 feet long, and is worked back 10 to 15 feet into the hill.

No other quarries were observed on this ledge.

The **Upper Pittsburgh limestone** of White<sup>1</sup>, belonging 30 to 40 feet below the Pittsburgh coal and immediately above the Little Pittsburgh coal, was not observed. In the several sections measured its horizon was generally concealed.

### The Little Pittsburgh Coal.

At 40 to 50 feet below the Pittsburgh coal and between the Upper and Lower Pittsburgh limestones there frequently occurs a thin—10 to 18 inches—double-bedded coal that has been named the **Little Pittsburgh**<sup>2</sup> from its association with the thicker vein above. Its thickness and relative position in the rock column are exhibited in the sections for Randall, Cassville, Beechwood and VanVoorhis in Monongalia; for Fairmont in Marion; and for Meadland in Taylor.

The following section was measured at its crop near the J. W. Holland No. 1 well (317) in northern Grant district, Monongalia, 1.4 miles northeast of Laurel Point:

1. I. C. White, Vol. II, W. Va. Geol. Survey, p. 245; 1903.
2. I. C. White, Vol. II, W. Va. Geol. Survey, p. 245; 1903.

|  | Ft. | In. |
|--|-----|-----|
| Coal, Pittsburgh.....  | 10  | 0   |
| Concealed .....  | 24  | 0   |
| Coal .....0' 11 " } Little Pittsburgh coal..   | 1   | 11  |
| Slate, gray....0 2½ } (955' B- A. T.)  |     |     |
| Coal .....0 9½ }   |     |     |
| Shale .....  | 2   | 0   |
| Concealed .....  | 6   | 0   |
| Limestone, dark gray, many fossil spiroribis and other minute forms, Lower Pittsburgh..... | 7   | 0   |
| Concealed to top Holland well (317).....   | 14  | 0   |

Reger reports this coal 2 feet thick at an elevation of 960' A.T., aneroid, directly over 10 feet of hard limestone, along the highway in southern Grant district, Marion county, 0.5 mile north of Eldora.

In Taylor this coal is 12 inches thick where it crops in the road, 1 mile northwest of Pruntytown, coming there 45 feet below the Pittsburgh bed at an elevation of 1415' A.T., aneroid.

The vein is too thin and irregular to be mined successfully.

### The Lower Pittsburgh Limestone.

The Lower Pittsburgh limestone of White<sup>3</sup> belongs 50 to 60 feet below the Pittsburgh coal and 1 to 5 feet below the Little Pittsburgh bed. Its thickness and relative position to other formations are exhibited in the sections for Randall in Monongalia, and for Fairmont in Marion. It is generally 5 to 10 feet in thickness, dark gray in color, carrying many minutes Spiroribis fossils and other fresh water forms. The above section under the account of the Little Pittsburgh coal shows 7 feet of this ledge in northern Grant district, Monongalia.

This limestone is quite generally present in good thickness wherever its horizon crops, which follows closely the area outlined for the Pittsburgh coal on Map II; hence, it should furnish an abundance of fairly good road metal for the magisterial districts adjoining the Monongahela and West Fork rivers.

3. I. C. White, Vol. II, W. Va. Geol. Survey, p. 245; 1903.

### The Connellsville Sandstone.

The **Connellsville sandstone** of J. J. Stevenson belongs 75 to 100 feet below the top of the Conemaugh series, and was so named from its crop near the town of Connellsville, Pa. It is coarse, brown, massive, often pebbly and 15 to 40 thick. On pages 247-248 of Vol. II of the State Survey reports, I. C. White gives an account of this ledge in West Virginia. Its thickness and relative position to other formations are exhibited in the sections for Randall, Beechwood, Morgantown, VanVoorhis, Little Falls and Round Bottom in Monongalia county; for Glover Gap and Downs in Marion; and for Webster, Thornton, Stonehouse, Cecil and Knottsville in Taylor.

The high grade building stone from the Cox (formerly Lowe and Dille) quarries at Morgantown was placed at this horizon in Vol. II above mentioned, but the sections for Mona and Morgantown show the quarry rock representing a separate formation, 20 to 30 feet lower in the measures. However, the true Connellsville sandstone has been quarried to a small extent on the north hillside of Falling run at Morgantown at an elevation of 1110' A.T., aneroid, where it is coarse and grayish brown, furnishing a fair grade of building stone.

This ledge was once quarried in conjunction with the Lower Connellsville along the northeast hillside of the Monongahela river, 0.7 miles southeast of Beechwood, Monongalia county, where the following section was measured with hand-level by Reger:

|   | Thickness. | Total.     |
|---|------------|------------|
|   | Feet.      | Feet.      |
| Coal, Pittsburgh.....                               | 9          | 9          |
| Concealed .....                                     | 52         | 61         |
| Coal, slaty, Little Pittsburgh.....                 | 1          | 62         |
| Shale .....   | 7          | 69         |
| <b>Sandstone, massive, hard, Connellsville.....</b> | <b>33</b>  | <b>102</b> |
| Shale, dark (Little Clarksburg coal horizon)        | 1          | 103        |
| Shale, gray and limy.....                           | 10         | 113        |
| Iron ore.....                                       | 0.5        | 113.5      |
| Sandstone, shaly.....                               | 1.5        | 115        |
| <b>Sandstone, massive, Lower Connellsville..</b>    | <b>28</b>  | <b>143</b> |
| Shale, gray.....                                    | 1          | 144        |
| Slate, black.....                                   | 1          | 145        |
| Limestone, hard, Clarksburg.....                    | 1          | 146        |
| Concealed to river, Pool No. 13.....                | 94         | 240        |

No other quarries were observed on this ledge.

**The Little Clarksburg Coal.**

The **Little Clarksburg** coal of White<sup>4</sup>, belonging 110 to 130 feet below the top of the Conemaugh series and at the base of the Connellsville sandstone, is a thin—10 to 15 inches—double-bedded seam of rather wide persistence but of no present economic value. Its thickness and relative position in the rock column are exhibited in the sections for Randall and Mona in Monongalia; and for Meadland, Flemington and Thornton in Taylor. The following section measured at its crop on Stewart street, Morgantown, shows its structure when normal:

|                         | Ft.                      | In. |
|-------------------------|--------------------------|-----|
| 1. Shale .....          |                          |     |
| 2. Coal .....0' 10"     |                          |     |
| 3. Shale, gray.....0 1  | } Little Clarksburg... 1 | 3   |
| 4. Coal .....0 4        |                          |     |
| 5. Fire clay shale..... |                          |     |

(Elevation, 1725' A. T., aneroid).

It crops along the road one-fourth mile southeast of Easton, Monongalia, at an elevation of 1025' A.T., aneroid, with a thickness of 18 inches, 120 feet below the Pittsburgh coal.

In Taylor county Reger collected a sample of this coal for analysis and measured the following section at its crop on the north side of the B. & O. R. R. in Flemington:

|   |                    |     |
|---|--------------------|-----|
| 1. Sandstone, massive, Connellsville..... | 18'                | 0"  |
| 2. Coal, slaty.....0' 5"                  |                    |     |
| 3. Coal, good.....1 0                     | Little Clarksburg. | 1 5 |
| 4. Shale, gray.....                       | 6                  | 0   |
| 5. Limestone, good, Clarksburg.....       | 3                  | 0   |

(Elevation of coal 1060' B-A. T.)

The **composition** and **calorific value** of the sample from No. 3 only of section are given under No. 69 (Laboratory No. 563H) in the table of coal analyses.

**The Lower Connellsville Sandstone.**

In the interval separating the Little Clarksburg coal and

4. I. C. White, Bull. 65, U. S. G. Survey, p. 88; 1891.

the Clarksburg limestone there sometimes occurs a massive, coarse, brown and arenaceous stratum, mottled with brown specks of peroxide of iron, 10 to 20 feet thick, that has long been quarried for building purposes in the vicinity of Morgantown. Here its thickness and relative position in the rock column at the Cox quarry are exhibited in the Morgantown section; and for the O. H. Dille quarry, in the Mona section. It is one of the finest building stones in the State on account of its durable qualities and reddish brown color. For all structures like bridge piers and outside walls it has no superior, due to its resistance to weathering. The old suspension bridge piers at Morgantown as well as the present post office building were built of stone from this ledge.

It is this sandstone that is quarried on the John D. Anderson land just east of the Kingwood pike, 1 mile southeast of Morgantown, where the following section was measured:

|  | Ft. | In. |
|--|-----|-----|
| Shale, sandy and reddish.....  | 15  | 0   |
| Sandstone, shaly.....  | 3   | 0   |
| Sandstone, massive, pebbly, mottled with brown<br>peroxide of iron, Lower Connellsville..... | 15  | 0   |
| (Elevation of quarry, 1100' A. T., aneroid).   |     |     |

The stone from this quarry is hauled to Morgantown for general building purposes, and some was used in the construction of the wall around the Second Ward school building.

This formation does not appear very persistent, being more or less lenticular, since it was observed at only two other points away from the immediate Morgantown region. One of these was at the quarry near Beechwood, mentioned above under the description of the Connellsville sandstone; and the other, near the summit of the river hill, 0.5 mile northeast of Little Falls station (See Little Falls section).

### The Clarksburg Limestone.

From a few inches to 20 feet below the Little Clarksburg coal there occurs a dark gray calcareous formation, 10 to 30 feet thick, that has been designated the **Clarksburg limestone**<sup>5</sup>

5. I. C. White, Bull. No. 65, U. S. G. Survey, p. 88; 1891.

from its crop in the town of that name in Harrison county. Its thickness and relative position in the rock column are exhibited in the sections for Randall and Mona in Monongalia, and for Meadland in Taylor. The approximate position of its crop around the hillsides can be determined readily by subtracting 150 feet from the elevation of the Pittsburgh coal as shown on Map II.

In Monongalia county, the following section was measured at the crop of this limestone in the old shale pit of the Randall Brick Co. in the north edge of Star City:

|  | Ft. | In. |
|--|-----|-----|
| Concealed .....  | 5'  | 0"  |
| Shale, black.....  | 3   | 0   |
| Limestone, dark gray, ferriferous and fossiliferous,<br>Clarksburg ..... | 6   | 0   |
| Shale, red and variegated, Clarksburg.....                               | 25  | 0   |
| (Elevation of limestone, 880' B-A. T.)                                   |     |     |

In the southern border of Grant district, same county, Reger measured the following section at its crop on the west hillside of the Monongahela river opposite Opekiska:

|   | Feet.                      |
|---|----------------------------|
| Sandstone, Connellsville.....                   | 25                         |
| Concealed .....                                 | 24                         |
| Limestone, hard.....6'                          | } Clarksburg Limestone.... |
| Shale, limy.....7                               |                            |
| Limestone, hard.....2                           |                            |
| Shale, limy.....3                               |                            |
| Limestone, hard.....6                           |                            |
| (Elevation of base of limestone, 870' B- A. T.) |                            |

In Winfield district, Marion, 5 feet of this ledge is visible in the public road, 0.8 mile southeast of Catawba, at an elevation of 1240' A.T., aneroid.

In the southern edge of Grant district, same county, this limestone crops along the road, 1 mile northeast of Boothsville, at an elevation of 1230' A.T., aneroid, where the following section is exposed:

|   | Ft. | In. |
|---|-----|-----|
| Shale, sandy.....                           | 10  | 0   |
| Shale, dark, coaly, Little Clarksburg.....  | 0   | 10  |
| Fire clay shale .....                       | 1   | 0   |
| Limestone, dark gray, hard, Clarksburg..... | 4   | 0   |



In the eastern border of Flemington district, Taylor, Reger collected a sample of this ledge for analysis and measured the following section on the east bank of Berry run in the north edge of Flemington:

|   | Feet. |
|---|-------|
| Sandstone, massive, Connellsville.....  | 20    |
| Limestone, dark gray, Clarksburg.....   | 4     |
| Concealed .....                         |       |
| (Elevation of limestone, 1040' B-A. T.) |       |

The composition of the sample is reported by Messrs. Hite and Krak as follows:

|   | Per cent.    |
|---|--------------|
| Silica (Si O <sub>2</sub> ).....                      | 3.45         |
| Ferric Iron (Fe <sub>2</sub> O <sub>3</sub> ).....    | 1.62         |
| Alumina (Al <sub>2</sub> O <sub>3</sub> ).....        | 0.57         |
| Calcium Carbonate (Ca CO <sub>3</sub> ).....          | 83.13        |
| Magnesium Carbonate (Mg CO <sub>3</sub> ).....        | 8.35         |
| Phosphoric Acid (P <sub>2</sub> O <sub>5</sub> )..... | 0.19         |
| Loss on ignition.....                                 | 1.70         |
| <b>Total .....</b>                                    | <b>99.01</b> |

One mile and a half southward this formation was once quarried to burn into agricultural lime. Here, Reger collected another sample for analysis and measured the following section at the quarry face:

|  | Feet. |
|--|-------|
| 1. Sandstone, massive, brown and pebbly, Connellsville.. | 20    |
| 2. Concealed .....                                       | 8     |
| 3. Limestone, good, Clarksburg.....                      | 4     |
| 4. Shale, gray.....                                      | 3     |
| 5. Shale, with limestone boulders.....                   | 15    |
| (Elevation of limestone (No. 3), 1025' A. T., aneroid).  |       |

The composition of the sample is reported by Messrs. Hite and Krak as follows:

|   | Per cent.    |
|---|--------------|
| Silica (Si O <sub>2</sub> ).....                      | 3.65         |
| Ferric Iron (Fe <sub>2</sub> O <sub>3</sub> ).....    | 2.17         |
| Alumina (Al <sub>2</sub> O <sub>3</sub> ).....        | 0.41         |
| Calcium Carbonate (Ca CO <sub>3</sub> ).....          | 82.34        |
| Magnesium Carbonate (MgCO <sub>3</sub> ).....         | 9.18         |
| Phosphoric Acid (P <sub>2</sub> O <sub>5</sub> )..... | 0.20         |
| Loss on ignition.....                                 | 1.57         |
| <b>Total .....</b>                                    | <b>99.52</b> |

In Courthouse district, same county, this formation crops along a Baltimore & Ohio R. R. cut, one-fourth mile west of Bryden, where it is separated into two separate ledges, and there Reger collected samples for analysis and measured the following section:

|  | Ft. | In. |
|--|-----|-----|
| 1. Sandstone, gray hard, massive, Connellsville. | 25  | 0   |
| 2. Coal, Little Clarksburg.....                  | 0   | 6   |
| 3. Shale, gray.....                              | 2   | 6   |
| 4. Limestone, good..... 4' } Clarksburg          |     |     |
| 5. Shale, red.....15 } Limestone .....           | 25  | 0   |
| 6. Limestone, good..... 6 }                      |     |     |
| 7. Shale, gray.....                              | 3   | 0   |

(Elevation of limestone, 1130 B-A. T.)

The composition of the samples collected separately from No. 4, No. 5, and No. 6 of the section is reported as follows by Messrs. Hite and Krak under Lab. Nos. 566H, 567H and 568H, respectively:

|   | No. 4        | No. 5         | No. 6        |
|---|--------------|---------------|--------------|
| Silica (Si O <sub>2</sub> ).....                      | 16.82        | 55.88         | 9.96         |
| Ferric Iron (Fe <sub>2</sub> O <sub>3</sub> ).....    | 7.17         | 8.17          | 4.12         |
| Alumina (Al <sub>2</sub> O <sub>3</sub> ).....        | 4.44         | 21.71         | 2.34         |
| Calcium Carbonate (Ca CO <sub>3</sub> )..             | 51.57        | .....         | 73.34        |
| Magnesium Carbonate (Mg CO <sub>3</sub> )             | 14.66        | .....         | 7.89         |
| Phosphoric Acid (P <sub>2</sub> O <sub>5</sub> )..... | 0.45         | 0.25          | 0.36         |
| Lime (Ca O).....                                      | .....        | 0.75          | .....        |
| Magnesia (Mg O).....                                  | .....        | 1.95          | .....        |
| Soda (Na <sub>2</sub> O).....                         | .....        | 0.56          | .....        |
| Potassa (K <sub>2</sub> O).....                       | .....        | 3.44          | .....        |
| Titanium (Ti O <sub>2</sub> ).....                    | .....        | 0.32          | .....        |
| Moisture .....  | .....        | 0.90          | .....        |
| Loss on ignition.....                                 | 4.28         | 6.39          | 1.54         |
| <b>Totals .....</b>                                   | <b>99.39</b> | <b>100.32</b> | <b>99.55</b> |

The above limestone analyses (Nos. 4 and 6) show these ledges to be adapted to the manufacture of natural cement, agricultural lime, and road material.

The results of analysis No. 5 show the red shale to be adapted to the manufacture of building brick with a deep red color, due to the high ferric iron content.

The Clarksburg red shale<sup>6</sup> was observed at one or two localities in the area, and is noted in the sections for Thorn-

6. Ray V. Hennen, Doddridge-Harrison Rept., W. Va. Geol. Sur., p. 240; 1912.

ton and Cecil. It was also used by the Randall Brick Co. at Star City to manufacture brick, as shown in the section given above under the account of the Clarksburg limestone.

### The Morgantown Sandstone.

At 40 to 50 feet below the Clarksburg limestone at Morgantown there occurs a massive, arenaceous stratum, 20 to 40 feet thick, named the **Morgantown sandstone** by J. J. Stevenson. It has been quarried there quite extensively for the construction of the State University buildings and other structures, concerning which I. C. White gives the following on page 250 of Vol. II of the State Survey reports:

"At this typical locality the top of the sandstone lies a little more than 200 feet below the Pittsburgh coal, and the stratum has a thickness of twenty-five feet. It is usually of a yellowish gray cast, and splits readily into building blocks of any desired size. The rock contains much feldspathic material, and occasionally some lime, and in weathering the rock changes from a bluish gray cast to a dirty brown, and frequently decomposes readily, so that as a building stone for exposed surfaces, it is not a success, some of the stone work at the State University at Morgantown having disintegrated badly within a period of twenty-five years.

"Several of the locks along the Monongahela river, between Morgantown and Pittsburgh, have been constructed of this stone, and the disintegration of the lock walls is a constant source of expense."

Its thickness and relative position to other formations are exhibited in the sections for Beechwood, VanVoorhis, Morgan Run, Easton, and Mona in Monongalia; and for Flemington and Cecil in Taylor. It crops over practically the same area as that outlined above for the Clarksburg limestone, and generally forms a steep bluff or slope around the hillsides. This sandstone forms the great cliffs in the northeast corner of Cass district, Monongalia, on Crooked run; also along the west hillside of the Monongahela between Maidsville Landing and VanVoorhis. It is a prominent cliff former along the same stream between Morgantown and Fairmont.

It is this formation that is quarried on the Lowry Smith farm on the north bank of Robinson run, 0.2 mile north of Maidsville Landing, where the following section was measured:

|   | Feet.                 |
|---|-----------------------|
| 1. Sandstone, massive,<br>bluish gray.....15'     | } Morgantown ..... 25 |
| 2. Sandstone, flaggy, to<br>base of quarry.....10 |                       |
| 3. Concealed to Robinson run.....                 | 15                    |
| (Elevation of quarry, 825' A. T., aneroid).       |                       |

The face of the quarry is 60 feet long and has been worked back into the hill 15 feet. The stone is used for house foundations and for culverts along the Buckhannon & Northern Railroad.

This stratum has also been quarried to furnish stone culverts for the same railroad, one-half mile northeastward, along the west hillside of the river. Here, it is gray and brown in color, medium-grained and crops in a cliff 40 feet high.

In Union district, Marion, 15 feet of the upper portion of this ledge is quarried to a small extent at the east edge of the road on Hickman run, 1.2 miles southeast of the B. & O. R. R. station at Fairmont. The base of the quarry has an elevation of 1030' A.T., aneroid, 200 feet below the horizon of the Pittsburgh coal.

The Morgantown sandstone is the "Murphy Sand" of the oil and gas well drillers, and has produced oil in Marshall and Wirt counties, West Virginia, and in Greene county, Pa., near the mouth of Dunkard creek.

### The Elk Lick Coal.

The Elk Lick coal of the First Geological Survey of Pa. belonging from a few inches to 10 feet below the Morgantown sandstone, is fairly persistent, and, in the vicinity of Morgantown, Monongalia county, attains minable thickness. It crops 230 to 250 feet below the Pittsburgh coal and 50 to 75 feet above the fossiliferous Ames limestones. Its thickness and relative position in the rock column are exhibited in the sections for Beechwood, Easton, Morgantown, Sabraton, Mona and Round Bottom in Monongalia; and for Meadland in Taylor.

In **Monongalia county** an unsuccessful attempt was recently made to mine this bed on a commercial scale along th

east hillside of the Monongahela river, opposite Mona (Granville). Here Reger collected a sample of the coal for analysis and obtained the following data:

**Regal Coal Co. Mine, Elk Lick Coal.—No. 69 A, Map II.**

|  | Ft. | In. |
|--|-----|-----|
| 1. Sandstone, massive, Morgantown..... | 25  | 0   |
| 2. Shale, gray.....                    | 0   | 6   |
| 3. Coal, hard, Elk Lick.....           | 2   | 6   |
| 4. Shale, gray.....                    | 2   | 0   |
| 5. Limestone, hard, Elk Lick.....      | 1   | 0   |
| 6. Shale, gray.....                    | 2   | 0   |

(Elevation of coal, 903' A. T., spirit level).

"Sample was taken in main heading, about 100 feet from the mine mouth from freshly cleaned face of coal. Coal is about 6 inches thicker at mouth of mine, but at the end of the main heading, about 200 feet in, the coal has been completely replaced by gray shale."

The composition of the sample is given under **No. 69A** (Laboratory No. 814H) in the table of coal analyses.

On the east side of the ravine in the north edge of Sabraton, there crops the greatest thickness of the Elk Lick coal observed in the area, as exhibited in the Sabraton section, page 118.

It is only 12 inches thick where it crops in the road at an elevation of 1210' A.T., aneroid, 1.3 miles N 10° W of Dellslow.

Both in **Marion** and **Taylor** counties this coal is too thin, impure and irregular to be classed as a minable coal. However, an attempt to mine this vein was made in Booths Creek district, Taylor, 1.5 miles east of McGee, at an elevation of 1470' A.T., aneroid, on the Albert M. Brown farm. Here, according to Isaac Brown, the bed at one place showed 4½ feet of clean coal, but thinned down to only 6 or 8 inches. The following section was obtained at an opening in the same vein on the land of Isaac Brown, 0.3 mile westward, at about the same elevation:

|   | Feet. |
|---|-------|
| Black slate with coal streaks .....   | 4' 6" |
| Coal .....  | 0 6   |
| Sandstone, hard, coarse brown, massive, pebbly, forms great cliffs and boulders, Grafton..... | 50    |
| } Elk Lick coal.....  | 5     |

Slightly over a mile south of McGee this coal is only 4 inches thick where it crops in the ridge road at an elevation of 1435' A.T., aneroid, and only 3 inches thick, in the road, 0.7 mile northeast of Meadland. About the same thickness of coal occurs at this horizon at Boothsville, Knottsville and northward from Cecil.

**The Elk Lick Limestone.**

The Elk Lick limestone of Messrs. Pratt<sup>7</sup>, belonging from 1 to 20 feet below the coal last described, is a widely persistent formation, ranging in thickness from 5 to 15 feet in layers separated by limy shale, and is dark gray in color and of fresh or brackish water origin.

In Union district, Monongalia, a sample of this limestone was collected for analysis and the following section measured at its crop on the east side of Cheat river, 1.4 miles northwest of Ices Ferry bridge over the latter stream:

|  |       |                             |
|--|-------|-----------------------------|
|  | Feet. |                             |
| 1. Sandstone, massive, Morgantown.....           | 15    |                             |
| 2. Concealed .....                               | 25    |                             |
| 3. Limestone .....                               | 2'    | } Elk Lick Limestone..... 8 |
| 4. Concealed .....                               | 1     |                             |
| 5. Coal .....                                    | 1     |                             |
| 6. Shale, limy.....                              | 2     |                             |
| 7. Limestone gray and<br>hard weathered yellow.2 | 2     |                             |
| (Elevation of limestone, 955' B-A.T.)            |       |                             |

The composition of the sample from No. 7 only of section is reported by Messrs. Hite and Krak as follows:

|  |              |
|--|--------------|
|  | Per cent.    |
| Silica (Si O <sub>2</sub> ).....                   | 13.86        |
| Ferric Iron (Fe <sub>2</sub> O <sub>3</sub> )..... | 5.64         |
| Alumina (Al <sub>2</sub> O <sub>3</sub> ).....     | 3.23         |
| Calcium Carbonate (Ca CO <sub>3</sub> ).....       | 62.95        |
| Magnesium Carbonate (Mg CO <sub>3</sub> ).....     | 10.90        |
| Loss on ignition.....                              | 2.86         |
| <b>Total .....</b>                                 | <b>99.44</b> |

In the extreme northwestern corner of Taylor county, this ledge crops in the southwest edge of Boothsville, 5 feet thick,

7. Report HHH, Second Geol. Survey of Penna.

at an elevation of 960' A.T., spirit level, 5 feet below the Elk Lick coal and 50 feet above the Upper Ames limestone. A sample for analysis was collected here, the composition of which is reported as follows by Messrs. Hite and Krak:

|   | Per cent. |
|---|-----------|
| Silica (Si O <sub>2</sub> ).....                      | 10.92     |
| Ferric Iron (Fe <sub>2</sub> O <sub>3</sub> ).....    | 3.67      |
| Alumina (Al <sub>2</sub> O <sub>3</sub> ).....        | 2.54      |
| Calcium Carbonate (Ca CO <sub>3</sub> ).....          | 30.62     |
| Magnesium Carbonate (Mg CO <sub>3</sub> ).....        | 41.73     |
| Phosphoric Acid (P <sub>2</sub> O <sub>5</sub> )..... | 0.22      |
| Loss on ignition and undetermined.....                | 10.30     |
| Total .....   | 100.00    |

The results class the ledge here as a dolomite, but too high in sandy and clayey matter for the manufacture of even coal or slow lime. It is best adapted to the manufacture of natural cement and road material.

In the northeast border of Courthouse district, Taylor, the Elk Lick limestone crops with a thickness of 5 feet along the ridge road between Berkeley run and Tygart Valley river, 1.8 miles southwest of Grafton, at an elevation of 1290' A.T., aneroid.

This formation adds greatly to the fertility of Conemaugh soils and should furnish a fair quality of road metal at the localities mentioned above.

### The West Milford Coal.

Immediately under the Elk Lick limestone there frequently occurs a thin—2 to 12 inches—slaty coal that has been designated the **West Milford**<sup>8</sup> coal from a town of that name in Harrison county.

The following section was measured at its crop in the extreme northwest point of Morgan district, Monongalia, along the B. & O. R. R. grade, directly opposite Maidsville Landing:

<sup>8</sup> Ray V. Hennen, Doddridge-Harrison Rept., W. Va., Geol. Sur., p. 246; 1912.

|   | Ft. | In. |
|---|-----|-----|
| Sandstone, massive, Morgantown.....             | 35  | 0   |
| Shale, gray.....                                | 0   | 6   |
| Coal .....0' 2" } Elk Lick coal.....            | 1   | 4   |
| Shale, gray.....1 0 }                           |     |     |
| Coal .....0 2 }                                 |     |     |
| Limestone, gray and hard, Elk Lick, 18" to..... | 5   | 0   |
| Shale, gray .....                               | 2   | 0   |
| Coal, slaty, West Milford.....                  | 0   | 2   |
| Fire clay shale .....                           | 6   | 0   |
| Shale, reddish.....                             | 5   | 0   |
| Concealed to river, Pool No. 9.....             | 30  | 0   |

(Elevation of West Milford coal, 836' A. T., spirit level).

The one foot of coal included in the Cheat river section given above under the description of the Elk Lick limestone may possibly correlate with the West Milford bed. In this case the coal is between two ledges of limestone.

This coal was not observed in either Marion or Taylor, and at no point in the area does it appear to attain minable thickness.

The **Birmingham shale** of J. J. Stevenson<sup>9</sup> has been largely replaced in this area by the Grafton sandstone.

### The Grafton Sandstone.

At 1 to 20 feet below the Elk Lick limestone and 15 to 20 feet above the Harlem coal in the vicinity of Grafton, Taylor county, there occurs a massive, coarse, pebbly and arenaceous stratum, ranging in thickness from 20 to 40 feet, that has been designated from this place the **Grafton sandstone**<sup>10</sup>. As mentioned above it has almost entirely replaced the Birmingham shale. Its thickness, character and relative position to other formations are exhibited in the sections for Beechwood, Easton, Sabraton, Little Falls and Round Bottom in Monongalia county; for Montana Mines in Marion; and for Grafton, Irondale, Thornton, Stonehouse, Cecil and Hepzibah in Taylor. Wherever it crops it generally makes a steep bluff and sometimes cliffs and large boulders 260 to 275 feet below the Pittsburgh coal. In Monongalia, Clinton district, the well-known "pictured rocks" along the east edge of the Kingwood

9. Report K, pp. 79 and 309-310, Sec. Geol. Survey of Penna.

10. I. C. White, Vol. II, W. Va. Geol. Survey, p. 255; 1903.



pike, 0.4 mile southeast of Ringgold, belong at this horizon. Here, on top of this sandstone, are found rude drawings of fish, deer, panthers and other animals, probably the work of Indians, concerning which Samuel T. Wiley<sup>11</sup> gives the following:

"The 'Pictured Rock,' about four or five miles from Morgantown, is now so covered and overgrown that deciphering its rude engraved figures, cut by the Indians, is a very difficult task. Years ago they were clearly discernible, and Howe, in his history of Virginia, says at page 382:

"On the plantation of Henry Hamilton there is a large flat rock, about 150 feet long and 50 wide, with numerous engravings of animals, well executed—such as panthers of full size, buffalo-tracks, horse-tracks, deer-tracks, turkey-tracks, eels, fish, women large as life, human-tracks, otters, beavers, snakes, crows, eagles, wild cats, foxes, wolves, raccoons, opossums, bears, elks, etc.'"

It is this ledge that is quarried in the same district along Kingwood pike,  $\frac{1}{4}$  mile north of Ridgedale, where the following data was obtained by Reger:

|   | Ft. | In. |
|---|-----|-----|
| <b>Sandstone, massive, quarry rock, capping knob, Grafton</b> ..... | 10  | 0   |
| Concealed .....   | 20  | 0   |
| Shale, marine fossils, Ames .....                                   | 14  | 0   |
| Coal, Harlem (1555' B-A. T.) .....                                  | 1   | 0   |
| Shale, yellow .....   | 30  | 0   |

"Stone has lately been quarried for building purposes, and is coarse-grained, medium hard, micaceous, free from pebbles and a beautiful reddish brown in color, splitting readily and requiring little work to finish into perfect building blocks."

In Taylor this stratum attains a slightly better development than in either of the two other counties. It holds up the wide, flat ridges southward from McGee to Meadland. At Grafton it is the prominent cliff capping the hill in the north edge of the city (See Grafton section, page 152). The falls in Swamp run, 1.3 miles southeast of Knottsville, are in this sandstone. It is quarried on a small scale for building stone—mostly from large boulders of the parent ledge—by James McCue, Joseph McCue, Boggs Stark and Henry Jackson, along the road, 0.5 mile due north of Fetterman. Here the stone is coarse, brown and mottled with iron oxide, splitting readily

11. History of Monongalia County, W. Va., pp. 26-27; 1883.

into blocks of any desired form. The product is hauled to Grafton where it has a good reputation for durability and resistance to weathering.

### The Ames Limestones.

At 275 to 300 feet below the Pittsburgh coal and 5 to 20 feet below the Grafton sandstone, there belongs a calcareous and very fossiliferous formation in northern West Virginia that was named by Andrews of the Ohio Geol. Survey the **Ames limestone**. It often occurs in two layers each 1 to 5 feet in thickness, separated by 10 to 20 feet of dark green shale with marine fossils in profusion; the top limestone being called the **Upper Ames**; the bottom, the **Lower Ames**; and the fossiliferous formation between, the **Ames shale**<sup>12</sup>.

Both the limestones and shale carry a large number of marine fossils, and from a scientific standpoint, are considered the most interesting formations in the entire Appalachian field. I. C. White gives an excellent description of the distribution, character and fossil fauna of the same in this State on pages 256-261 of Vol. II of the State Survey reports. The limestones are more or less irregular and lenticular, but the shale is nearly always present and easily identified, owing to its dark green color and fossils. Their thickness and relative position in the rock column are exhibited in the sections for Beechwood, VanVoorhis, Morgantown, Sabraton, Aaron Run, Rock Forge, Little Falls, Anita, Mona and Round Bottom in Monongalia county; for Downs in Marion; and for Meadland, Webster, Grafton, Irondale, Thornton, Stonehouse, Cecil and Hepzibah in Taylor. These are very important key rocks in determining the approximate elevation of the Pittsburgh coal horizon after the latter passes into the air.

In Monongalia, at Morgantown, a fine exposure of both the limestones and shale along with the underlying Harlem coal occurs along the electric railroad grade at Point Breeze in Fourth Ward. Another good exposure is found in the east edge of the same town, in the deep cut about half-way up the

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12. Ray V. Hennen, Doddridge-Harrison Rept., W. Va. Geol. Sur., p. 250; 1912.

north hillside of Deckers creek. All are exposed along the hill road leading west from Dents run, slightly over a mile south of Mona (Granville).

In Marion, their crop is confined to Winfield, Union and Grant districts. In the extreme southern point of the latter area these limestones are in the bed of Husted creek, one-eighth mile east of Boothsville, where a sample was collected for analysis and the following section measured:

**Boothsville Section, Showing Ames Limestone.**

|   | Ft. | In. |
|---|-----|-----|
| Shale, sandy.....   | 5   | 0   |
| Coal, slaty, Elk Lick.....  | 0   | 2   |
| Shale, black, fossil plants, prolific.....                                | 4   | 0   |
| Limestone, dark gray, Elk Lick.....                                       | 5   | 0   |
| Concealed .....   | 2   | 0   |
| Sandstone, massive, coarse gray, Grafton.....                             | 35  | 0   |
| Concealed .....   | 3   | 0   |
| Shale, sandy.....   | 5   | 0   |
| Limestone, dark gray, marine fossils prolific,<br>Ames, to creek bed..... | 5   | 0   |

The composition of the sample from the Ames is reported by Messrs. Hite and Krak as follows:

|   | Per cent.    |
|---|--------------|
| Silica (Si O <sub>2</sub> ).....                      | 6.55         |
| Ferric Iron (Fe <sub>2</sub> O <sub>3</sub> ) } ..... | 3.32         |
| Alumina (Al <sub>2</sub> O <sub>3</sub> )... }        |              |
| Calcium Carbonate (Ca CO <sub>3</sub> ).....          | 85.47        |
| Magnesium Carbonate (Mg CO <sub>3</sub> ).....        | 0.86         |
| Phosphoric Acid (P <sub>2</sub> O <sub>5</sub> )..... | 0.20         |
| Loss on ignition .....                                | 3.43         |
| <b>Total .....</b>                                    | <b>99.83</b> |

The results reveal a fairly good limestone, although as a rule it seems higher in silica.

Southward in Taylor county one of the Ames limestones is found in the bed of Booths creek, 0.3 mile north of Santiago. The high knob on Hammond ridge, 0.9 mile northwest of Valley Falls, just barely catches the Ames shale in its summit, at an elevation of 1630' A.T., aneroid. This is very near the crest of the Chestnut Ridge anticline. Southwest along the axis of the latter fold to near Meadland it crops close to the summits of the hills, and eastward, near the hill tops at Grafton and Cecil.

**Fossil Fauna.**—The Ames limestones and shale is one of the three rich marine fossil horizons of the Conemaugh series. During the latter part of 1911 collections were made in five different counties of West Virginia from these formations under the supervision of Dr. J. W. Beede of the University of Indiana, an expert on the Carboniferous invertebrate fauna of the western States. The specimens collected were studied and identified by Dr. Beede, whose report on those from Harrison county is given on pages 254-255 of the Doddridge-Harrison report of the State Survey, and those from Monongalia, Marion, Taylor and Preston counties as follows:

**Monongalia County\*.** Point Breeze Cut. Morgantown.  
Upper Ames Limestone:

*Ambocoelia planoconvexa.*  
*Chonetes granulifer*, a.  
*Composita argentea*, a.  
Crinoid fragments.  
*Deltopecten occidentalis?*  
*Derbya crassa.*  
*Myalina?* sp.  
*Productus cora.*  
*Productus nebraskensis*, a.

**Ames Shale:**

*Ambocoelia planoconvexa.*  
*Euphemus carbonarius.*  
*Nucula parva*, a.  
Plant.  
*Patellostium montfortianum.*  
*Pleurotomaria* sp.  
*Strophalosia?* sp.

**Ames Shale Immediately Over Lower Ames Limestone:**

*Ambocoelia planoconvexa*, a.  
*Bellerophon* sp.  
*Chonetes granulifer.*  
*Euomphalus catilloides.*  
*Euphemus carbonarius.*  
*Gastropod* sp.  
*Leda attenuata.*  
*Leda bellistriata.*  
*Nucula parva*, c.  
*Patellostium montfortianum.*  
*Pelecypod* sp.  
*Pleurotomaria* sp.  
*Tainoceras occidentalis?*

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\*In these lists, "a" means the specimens of species are abundant; "c." common; and "r," rare.

## Lower Ames Limestone:

*Ambocoelia planoconvexa*, c.  
*Aviculopecten?* sp., r.  
*Chonetes granulifer*, a.  
*Nucula parva*, a.  
*Pelecypod* sp.  
*Pleurophorus* sp.  
*Strophalosia* sp.

## Hill Road, Two Miles Due West of Morgantown.

## Lower Ames Limestone:

*Chonetes granulifer*.  
*Strophalosia* sp.

## Rogers Cut, East Morgantown:

## Upper Ames Limestone:

*Ambocoelia planoconvexa*.  
*Chonetes granulifer*, c.  
*Composita argentea*, a.  
 Crinoid fragments.  
*Deltopecten occidentalis?*  
*Myalina subquadrata*, c.  
*Pelecypod*.  
*Productus cora*.  
*Productus nebraskensis*, a.

## Upper Ames Limestone and Shale (wash):

*Ambocoelia planoconvexa*  
 Bryozoan sp.  
*Chonetes granulifer*.  
*Composita argentea*, a.  
 Crinoid fragments.  
*Deltopecten occidentalis*.  
*Myalina subquadrata*.  
*Productus cora*.  
*Productus nebraskensis*, c.  
*Rhipidomella pecosi*, c.  
*Spirifer Cameratus*.  
*Strophalosia* sp.

## Lower Ames Limestone:

*Chonetes granulifer*, a.  
*Nucula parva*, c.  
*Patellostium montfortianum*, r.

## Marion County. Boothsville, East Edge of.

## Upper Ames Limestone:

Masses of *Chonetes granulifer*.  
*Productus cora*.

**Taylor County. Pruntytown, 1.5 miles NW of, Brush Hill Road.****Ames Shale:**

*Ambocoelia planoconvexa.*  
*Aviculopecten?* sp.  
*Aviculopinna americana?*  
*Bellerophon* sp.  
*Bellerophon percarinatus.*  
*Bullmorpha* sp.  
*Edmondia?* sp.  
*Euphemus carbonarius.*  
*Leda attenuata, c.*  
*Nucula* sp.  
*Nucula ventricosa.*  
*Nucula parva.*  
 Ostracoda.  
*Patellostium montfortianum.*  
*Pelecypod* sp.  
*Productus cora.*  
*Productus nebraskensis.*  
*Strophalosia* sp.  
*Yoldia* sp.

**Preston County, 1 Mile NE of Kingwood, M. & K. R. R. Cut.****Ames Shale:**

*Aclisina?* sp  
*Aclisina swallowana.*  
*Ambocoelia planoconvexa, a.*  
*Astartella gurleyi, c.*  
*Astartella vera, r.*  
*Aviculopecten* sp., r.  
*Bullmorpha chrysalis.*  
*Bellerophon percarinatus.*  
*Bellerophon stevensanus?* r.  
*Bullmorpha* sp.  
*Bullmorpha?* sp.  
*Chonetes granulifer, c.*  
*Chonetes variolatus.*  
 Crinoid fragments.  
*Derbya crassa, c.*  
*Edmondia aspenwallensis?*  
*Endothyra?* sp., r.  
*Euomphalus catilloides.*  
*Euphemus carbonarius, c.*  
*Leda attenuata, c.*  
*Loxonema rugosum, r.*  
*Loxonema semicostatatum, r.*  
*Loxonema scitulum, r.*  
*Nucula parva, a.*  
*Orthoceras rushensis.*  
*Orthonema quadricarinatum.*  
*Orthonema?* sp.  
*Orthonema* Cf. *subtaeniatum, r.*  
*Patellostium montfortianum.*  
*Pelecypod.* Cf. *Allorisma geinitzi.*

Pelecypod. Two species.  
 Pleurophorus Cf. *obsoletus*.  
 Pleutomaria Cf. *brazoensis*.  
 Productus *cora*? r.  
 Serpula? sp., r.  
 Sphaerodoma *primigenia*?  
 Soleniscus *brevis*.  
 Soleniscus *paludinaeformis*?  
 Tainoceras *occidentalis*? r.  
 Worthenia Cf. *speciosa* a,

While Professor of Geology at the State University, Dr. J. J. Stevenson made a large collection of specimens from the Ames in the vicinity of Morgantown, and submitted the same to the late F. B. Meek for study and classification. Mr. Meek's letter to Dr. Stevenson, dated Nov. 8, 1870, and its accompanying list of fossils, as published on pages 257-259 of Vol. II of the State Survey reports, are as follows:

"The specimens sent from the lower Coal Measures are nearly all forms common in the coal series of Indiana, Illinois, Missouri, Kansas, Nebraska, etc., though few of them have before been found so far eastward. In some of the states mentioned, nearly all of these species range through the whole of the Coal Measures. Some of them, however, are locally more restricted. This great range of the species of invertebrate remains in the Coal Measures of the western states has long since satisfied me that these fossils cannot generally be relied upon as a means of identifying particular beds or horizons in our Coal Measures throughout wide areas; though particular grouping of species may sometimes serve as guides in this respect, within limited areas. The Coal Measure forms, however, enable us at once to distinguish beds of that age from any of the lower Carboniferous or older rocks.

"The great length of time through which most of these fossils must have continued to live, will be better understood when it is stated that nearly all of the species enumerated in this list from the lower Coal Measures of West Virginia, also occur even in the upper Coal Measure beds in Nebraska, referred by Profs. Marcou and Geinitz to the Permian or so-called *Dyas*. Indeed, the collections from these two widely separated localities and horizons, contain so many of the same species, that if shown to almost any geologist unacquainted with the range of species in our Coal Measures, he would scarcely hesitate to adopt the conclusion that they came from *exactly* the same horizon in the series. Yet from what is known of the geology of your region, and that of the states farther west, it is probable that the beds from which your collections were obtained, hold a position from 1,000 to 1,500 feet or more below those alluded to in Nebraska.

"From such facts as this, it would seem that although there were many elevations and depressions, as well as other consequent changes, the climatic and other physical conditions affecting animal life, must have remained remarkably uniform throughout the whole of the long continued coal period.

Very truly yours,  
 F. B. MEEK."

**List of Fossils identified by F. B. Meek from horizon of the  
Crinoidal or Ames Limestone, near Morgantown,  
West Virginia:**

\*Crinoidal fragments—Some pentagonal, star-shaped discs of columns.

Crinoidal columns.

Hemiphronites *crassus* Meek and Hayden.

Chonetes *smithi* Norwood and Pratten.

Chonetes. Seem to differ from *C. granulifera*, Owen, only in being smaller.

\**Productus nebrascensis* Owen.

\**Productus prattenanus* Norwood.

\**Productus semireticulatus* Martin sp. Seems to be rare in our beds.

\**Discina nitida* (?)

\**Pseudomonotis*. (Monotis of some authors but not of Brown). A fragment, but showing exactly the irregular regulating costae and striae, with vaulted scales seen on the ribs in that genus.

\**Aviculopecten carbonarius* Stevenson sp.—*Pecten* broadheadf Swallow, and *Pecten hawni* Geinitz.

\**Myalina subquadrata* Shumard, var. *ampia*.

*Myalina*. Undetermined species. Very small. Probably a young shell.

*Allorisma*. Undetermined species.

\**Nucula ventricosa* Hall.

\**Nucula parva* McChesney.

†*Nucula anodontoidea* Meek.

\**Nuculana bellistriata* Stevenson sp. A very small attenuated variety. Common in the so-called upper Dyas, Nebraska City, Nebraska.

*Astartella*. Undetermined species.

†*Macrodon obsoletus* Meek.

*Macrochellus primigenius* Conrad.

\**Macrochellus ventricosus* Hall.

*Macrochellus*. Undetermined species.

\**Bellerophon montfortianus* Norwood and Pratten.

*Bellerophon percarinatus* Conrad.

\**Bellerophon carbonarius* Cox.

*Bellerophon meekianus* Swallow.

\**Pleurotomaria grayvilliensis* Norwood and Pratten.

*Pleurotomaria*. Undetermined species. A very small depressed species.

\**Orothoceras cribrosum* Geinitz.

\**Nautilus occidentalis* Swallow.

*Nautilus*. Undetermined species.

*Productus*. Undetermined species. Very small, concentrically wrinkled.

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\*Species known to range through the whole of the Coal Measures in the West, even into the upper beds at Nebraska City, Neb., referred by Profs. Marcou and Geinitz to the Permian or so-called Dyas.

†New species.



\**Athyris substilita* Hall. Very abundant and presenting all the usual varieties.

\**Spirifer* (*Martinia*) *planoconvexus* Shumard.

\**Spirifer cameratus* Morton.

*Aviculopecten*. Undetermined species. Probably *A. occidentalis* Shumard.

At the end of this chapter is given a tabular list, prepared by Dr. Beede, of species common to the Ames, Pine Creek and Brush Creek limestones.

### The Harlem Coal.

At a few inches to 10 feet below the Ames limestones there occurs a thin—12 to 18 inches—very persistent coal in the northwestern portion of the State. It was first named the **Harlem coal**<sup>13</sup> by J. S. Newberry from a town of that name in Carroll county, Ohio, where it was mined in shafts. The names "Crinoidal" and "Friendsville" have been applied to the same bed by the Pennsylvania and Maryland Surveys, respectively. Its crop is confined to the eastern edge of Cass and Grant districts, and the northwest portions of Union, Morgan and Clinton in Monongalia; over most of the area of Winfield, Union and Grant districts, Marion; and in all the districts of Taylor. The approximate position of the bed can be readily ascertained therein by subtracting 330 feet from the elevation of the Pittsburgh coal as shown on Map II. Its thickness and relative position to other formations are exhibited in the sections for Beechwood, Easton, Morgantown, Aaron Run, Rock Forge, Little Falls, Anita and Round Bottom in Monongalia; and for Webster, Grafton, Irondale, Thornton and Hepzibah in Taylor.

In **Monongalia county** the following detailed section was measured at the crop of the Harlem coal along the east edge of Morgantown, in the deep cut on the north side of Deckers creek:

|   | Feet.    |
|---|----------|
| Limestone, in layers, marine fossils, Upper Ames..... | 4        |
| Shale, dark, bluish green, Ames.....                  | 10       |
| Concealed .....                                       | 9        |
| Limestone, marine fossils, Lower Ames.....            | 2        |
| Shale .....   | 1        |
| <b>Coal, Harlem</b> .....                             | <b>1</b> |
| (Elevation of coal, 930' A. T., aneroid).             |          |

13. Bull. Geological Society of America, Vol. 17, p. 156; 1906.

Along the electric railroad grade in the northwest edge of the same town this bed has a thickness of 18 inches. There both the Ames limestones and shale are finely exposed.

Two miles southwestward the following section was measured at its crop in the hill road leading west from Dents run, 1 mile due south of Mona (Granville):

|  | Ft.                | In. |
|--|--------------------|-----|
| Limestone, marine fossils, Lower Ames..... | 1                  | 6   |
| Shale .....                                | 4                  | 0   |
| Coal, slaty.....0' 6"                      | } Harlem coal..... | 1   |
| Shale, gray.....0 5                        |                    |     |
| Coal .....                                 |                    |     |
| Coal .....                                 | 0                  | 8   |
| Fire clay shale.....                       |                    | 7   |
| (Elevation of coal, 910' A. T., aneroid).  |                    |     |

In Marion this coal attains about the same development as in Monongalia county, as revealed by the following section measured by Reger at its crop in the extreme southern edge of Winfield district at the north end of the private road, 1.7 miles due west of Neel:

|  | Ft. | In. |
|--|-----|-----|
| Concealed from top of knob.....            | 35  | 0   |
| Shale, green, marine fossils, Ames.....    | 5   | 0   |
| Coal, Harlem.....                          | 1   | 6   |
| Shale, variegated and red, Pittsburgh..... | 60  | 0   |
| (Elevation of coal, 1685' A. T., aneroid). |     |     |

One-half mile S 30° W of Neel, on the crest of the Chestnut Ridge anticline, according to Reger, the same thickness of coal is exposed at this horizon, at an elevation of 1795' A.T., aneroid. Here it is overlaid by the same green fossiliferous shale. Two miles and a half northward, on the south side of the high knob located 0.2 mile south of Nebo church, this bed is only 12 inches thick, according to Reger, at an elevation of 1735' A.T., spirit level, coming immediately under a fossiliferous shale.

In Taylor the Harlem coal is slightly thicker in some localities than in the other two counties. It is this bed that was once mined on the Jas. B. Scrannage farm and likewise on the O. W. Scrannage farm at an elevation of 1444' A.T., spirit level, 0.2 mile northwest and 0.2 mile northeast of McGee, respectively. It is reported 24 inches thick at each

of these mines, but it perhaps carries a shale parting as shown by the following section measured at its crop, 1.6 miles north of McGee, at the milk-house of Nathan Curry, at an elevation of 1430' A.T., aneroid:

|   | Ft. | In. |
|---|-----|-----|
| Shale, black, marine fossils, Ames..... | 3   | 0   |
| Coal .....                              | 0'  | 5½" |
| Shale, black.....                       | 0   | 11  |
| Coal .....                              | 0   | 6   |
| Fire clay shale .....                   |     |     |
| Harlem coal.....                        | 1   | 10½ |

This coal dips rapidly southward along the nose of the Chestnut Ridge anticline to an elevation of 1265' A.T., spirit level, at its crop on the east bank of Plummer run, just south of the road fork, 1 mile eastward from Meadland:

|   | Ft. | In. |
|---|-----|-----|
| Shale .....                                       | 10  | 0   |
| Limestone silicious, marine fossils, Upper Ames.. | 2   | 6   |
| Shale, dark, marine fossils, Ames.....            | 6   | 0   |
| Coal, Harlem.....                                 | 1   | 0   |
| Fire clay shale to Plummer run.....               | 13  | 0   |

In the central portion of Courthouse district, Reger measured the following section at the crop of this coal in a B. & O. railroad cut, ¾ mile east of Bryden:

|  | Ft. | In. |
|--|-----|-----|
| Sandstone, shaly, Grafton.....             | 5   | 0   |
| Limestone, marine fossils, Upper Ames..... | 2   | 0   |
| Shale, brown.....                          | 10' |     |
| Shale, dark.....                           | 10  |     |
| Ames .....                                 | 20  | 0   |
| Coal, good, Harlem.....                    | 1   | 4   |
| Shale, yellow, to railroad grade.....      | 8   | 0   |
| (Elevation of coal, 1070' A. T., aneroid). |     |     |

In the northwest portion of Fetterman district this coal crops in the private road, 0.6 mile due east of "Dean Schoolhouse", at an elevation of 1620' A.T., aneroid, where the following section was measured, giving the thickest coal at this horizon observed in the area:

|  | Ft. | In. |
|--|-----|-----|
| Sandstone, Grafton.....                    |     |     |
| Shale, marine fossils, Ames.....           | 25  | 0   |
| Coal, slaty.....                           | 0'  | 8"  |
| Fire clay shale.....                       | 2   | 0   |
| Coal .....                                 | 2   | 0   |
| Harlem coal.....                           | 4   | 8   |
| Fire clay shale.....                       | 8   | 0   |
| Limestone, nodular, brecciated, Ewing..... | 2   | 0   |

The crop of this coal is well exposed along the road in the western border of Knottsville district, slightly over a mile due west of Eby, at an elevation of 1660' A.T., aneroid, where the following section was measured:

|   | Ft. | In. |
|---|-----|-----|
| 1. Sandstone, massive, Grafton.....             | 35  | 0   |
| 2. Shale, dark green, marine fossils, Ames..... | 17  | 0   |
| 3. Coal, Harlem.....                            | 1   | 2   |
| 4. Fire clay shale.....                         | 10  | 0   |

In this area the Harlem coal is too thin and irregular ever to be mined successfully, especially in competition with thicker and better coals in the same locality. No samples were collected for analysis, but a fair idea of its composition and fuel value in this portion of the State is given on pages 256-262 of the Doddridge-Harrison Report of the State Survey.

#### The Ewing Limestone.

The **Ewing limestone** of the Ohio Geological Survey, belonging 1 to 10 feet below the Harlem coal, is a dark gray stratum, weathering yellowish gray, and a fresh or brackish water deposit. Its thickness and relative position to other formations are exhibited in the sections for Rock Forge in Monongalia, and for Webster and Stonehouse in Taylor. It is generally more or less nodular, brecciated and irregular. Reger reports this ledge 5 feet thick in the bed of Robertson run,  $\frac{3}{4}$  mile north of Colfax, Marion county, at an elevation of 995' A.T., aneroid, and 4 feet thick along the hill road on the head of Reuben run, 1.6 miles east of Canton (Winfield).

In Taylor it appears in better development than in either of the other two counties. It is 3 feet thick and fairly pure at its crop along the road on Corbin branch along the western edge of Booths Creek district, 1 mile south of Santiago. It rises rapidly southward from the latter point and at the road fork, 2 miles N 85° W of Meadland, crops at an elevation of 1200' A.T., aneroid, where the following section was measured:

|  | Feet. |
|--|-------|
| Limestone, marine fossils, Lower Ames..... | 1     |
| Concealed .....                            | 10    |
| Coal, Harlem.....                          | 1     |
| Fire clay shale .....                      | 4     |
| Limestone, nodular, brecciated, Ewing..... | 4     |

In the southern border of Fetterman district the following section was measured at the crop of this limestone at the north edge of the Northwestern pike, 0.5 mile eastward from Blueville:

|   | Ft. | In. |
|---|-----|-----|
| Shale, dark, marine fossils, Ames.....          |     |     |
| Coal, Harlem .....                              | 0   | 6   |
| Fire clay shale and red shale.....              | 10  | 0   |
| Limestone, brecciated and nodular, Ewing.....   | 2   | 0   |
| Reds, Pittsburgh.....                           |     |     |
| (Elevation of limestone, 1320' A. T., aneroid). |     |     |

No sample of this limestone was collected for analysis, but a fair idea of its composition in this portion of the State is given on page 263 of the Doddridge-Harrison Report. Therein it is shown to be adapted to the manufacture of hydrated lime for agricultural purposes.

### The Pittsburgh Red Shale.

The **Pittsburgh Red Shale** of White<sup>14</sup>, belonging immediately under the Ewing limestone, is a soft, red or purple shale, often marly and containing nuggets of impure limestone and iron ore, the whole ranging in thickness from 30 to 100 feet. This band of reds is nearly always recorded by oil and gas well drillers in the area, and, on account of its bad caving tendency when penetrated by the drill, it is known as the "Big Red Cave"; hence, much care has to be exercised in drilling through the same to prevent losing the drilling tools. On pages 263-265 of Vol. II of the State Survey reports, I. C. White gives an interesting account of these shales. Their thickness and relative position in the rock column are exhibited in the sections for Easton, Morgantown and Round Bottom in Monongalia; for Downs in Marion; and for Meadland, Grafton, Thornton, and Cecil in Taylor.

14. I. C. White, Bull. No. 65, U. S. G. Survey, p. 92; 1891.

In Monongalia, the shale pit of the Morgantown Brick Company, in the northwest edge of Fourth Ward, Morgantown, is in this horizon, the composition and physical properties of which are given on pages 235-236 of Vol. III of the State Survey reports.

### The Saltsburg Sandstone.

The **Saltsburg sandstone** of J. J. Stevenson, belonging 40 to 60 feet below the Harlem coal and just above the Bakerstown coal, ranges from 15 to 30 feet in thickness and is very irregular both in character and distribution, sometimes being grayish white, massive and pebbly, and again greenish gray, flaggy and micaceous. It correlates with the Moundsville oil sand of the drillers. Its thickness, character and relative position in the rock column are exhibited in the sections for Easton, Morgantown, Sabraton, Aaron Run, Rock Forge and Triune in Monongalia; for Glover Gap, Downs and Montana Mines in Marion; and for Grafton, Irondale and Cecil in Taylor. On the State University campus at Morgantown, it is this ledge that forms the falls in Falling run, where it has lost its massive character. Southwestward along the Buckhannon & Northern Railroad grade, it has thickened up to 20 feet,  $\frac{1}{4}$  mile northeast of Round Bottom, being here dark gray, massive and medium grained, and coming 3 feet above the Pine Creek limestone.

No quarries were observed on this ledge.

### The Bakerstown Coal.

At 1 to 10 feet below the Saltsburg sandstone and 75 to 100 feet below the Ames limestone there belongs a coal that frequently attains minable thickness in West Virginia. This vein is known as the **Bakerstown**<sup>15</sup> coal, but is referred to in Maryland as the **Barton** vein. Although quite persistent in this area, it is very irregular in thickness as is revealed in the sections for Morgan Run, McClaren and Triune in Monongalia; and for Thornton, Thornton S W and Cecil in Taylor.

15. I. C. White, Report Q, Second Geological Survey, Penna.

In **Monongalia county** its crop is confined to the central portion of Union district and the western portions of Morgan and Clinton. In Union it is this bed that crops in the road near the residence of Mack Bayles, 0.4 mile southward from the Ices Ferry bridge over Cheat river, at an elevation of 993' A.T., spirit level. Here it is 3 feet thick and quite pure. This coal was also once mined on the east side of Cheat, near Ices Ferry bridge, by stripping and the coal used at the old Green Spring iron furnace operated there over 50 years ago, where it was reported 3 to 4 feet thick and of fair quality. Westward it appears to thin away, since it is only 16 inches thick in the McClaren boring (320), 1 mile southeast of VanVoorhis, and at Morgantown, has thinned away entirely where its horizon is exposed on the west side of the river. It also appears to be absent along the B. & N. R. R. grade, one-fourth mile northeast of Round Bottom; in fact, this same condition seems to hold true all along the river between Morgantown and Grafton.

In **Marion** the crop of this bed is confined to an area 3 to 4 miles wide, extending southwest across the central portions of Winfield, Union and Grant districts, but at no point was coal of minable thickness observed in the county. The following section was measured at its crop in the hill road in the eastern border of Grant, 0.6 mile westward from Hall Mill:

|   | Feet. |
|---|-------|
| Sandstone, massive, Saltsburg.....                | 20    |
| Shale, sandy, buff.....                           | 5     |
| Concealed .....                                   | 10    |
| Slate, black and concealed.....                   | 4     |
| Coal, Bakerstown.....                             | 1     |
| Concealed .....                                   | 25    |
| Limestone, gray and hard, Pine Creek, to run..... | 3     |
| (Elevation of coal, 1015' A. T., aneroid).        |       |

In **Taylor** the crop of the Bakerstown coal is confined to the northeast portion of Booths Creek district, over most of Fetterman and Knottsville, and the eastern border of Courthouse. The approximate position of its crop can readily be ascertained in this county as well as in Monongalia and Marion by subtracting 420 feet from the elevation of the

Pittsburgh coal as shown on Map II. It crops in the road 1 mile north of Fetterman at an elevation of 1160' A.T., aneroid, where it is only 6 inches thick. One-half mile west of Fetterman this coal was once opened on the south side of the pike at an elevation of 1110' A.T., aneroid. The mine had fallen shut so that it was not possible to get a section of the bed, but all signs demonstrated that it had not been satisfactory.

In the western edge of Booths Creek district this coal crops at the road fork on Corbin branch, 2.3 miles N 80° W of Meadland, at an elevation of 1074' A.T., spirit level, where it is only 13 inches thick.

In the southern edge of Knottsville district this coal has thickened up to minable dimensions 0.2 mile northwest of Cecil, where it has been mined for domestic fuel, having a thickness of 3 feet (see Cecil section, page 159).

Three-fourths mile northeast of Cecil a sample for analysis was collected and the following section was measured at a mine in this vein:

**J. J. Shroyer Mine, Bakerstown Coal—No. 71 on Map II.**

|  | Ft. | In. |
|--|-----|-----|
| 1. Sandstone, visible, Saltsburg.....      | 7   | 0   |
| 2. Shale, sandy.....                       | 6   | 0   |
| 3. Shale, dark.....                        | 2   | 0   |
| 4. Coal, bony.....0' 3" } Bakerstown ..... | 2   | 8   |
| 5. Coal, good, soft....2 5 }               |     |     |
| 6. Fire clay shale.....                    |     |     |

(Elevation of coal, 1375' A. T., aneroid).

The composition, calorific value and fuel ratio of the sample from No. 5 only of section are given under **No. 71** (Laboratory No. 574H) in the table of coal analyses.

One mile and a half N 75° E of Knottsville an attempt was made to mine this bed near the road fork, on the east hillside of Glade run, at an elevation of 1516' A.T., spirit level. The mine had fallen shut: hence, a section could not be obtained.

Along the Eastern border of Knottsville district the following section was measured at the crop of this coal in the road, 0.6 mile southwest of Eby:



|                           | Ft. | In. |
|---------------------------|-----|-----|
| Shale, red and sandy..... | 15  | 0   |
| Coal, Bakerstown.....     | 1   | 1   |
| Fire clay shale.....      | 5   | 0   |

(Elevation of coal, 1615' B-A. T.)

In the northern edge of the same district, Reger collected a sample for analysis and measured the following section at a mine in this bed on the west hillside of Rocky branch, 1.2 miles N 10° E of Knottsville:

**John Williams Mine, Bakerstown Coal—No. 70 on Map II.**

|  | Ft. | In. |
|--|-----|-----|
| 1. Slate .....                         |     |     |
| 2. Coal, good.....1' 7 " }             |     |     |
| 3. Slate .....0 0½ } Bakerstown .....  | 2   | 5½  |
| 4. Coal, good .....0 10 }              |     |     |
| 5. Shale, gray.....                    | 3   | 0   |
| 6. Concealed .....                     | 20  | 0   |
| 7. Shale, green, brecciated, limy..... | 10  | 0   |

(Elevation of coal, 1260' B-A. T.)

The composition, calorific value and fuel ratio of the sample from Nos. 2, 3 and 4 are given under **No. 70** (Laboratory No. 581H) in the table of coal analyses.

The results of the two analyses show this bed to be an exceptionally good coal for fuel purposes.

This coal is only 6 inches thick at its crop in the road, 2.3 miles northwest of Irontown and 0.2 mile northeast of the U. S. G. Survey bench mark—1506' A.T.—where, according to Reger, it comes 100 feet below the Harlem coal, at an elevation of 1585' A.T., aneroid.

Sufficient data have been given to show that the Bakerstown coal in each of the three counties is very patchy and irregular in its nature and for that reason can hardly be classed as a minable coal at present. However, Union district, Monongalia, and Knottsville district, Taylor, should sometime furnish a fairly large tonnage of this coal when the better and thicker veins approach exhaustion.

**The Pine Creek Limestone.**

The Pine Creek limestone of I. C. White<sup>16</sup>, belonging 90

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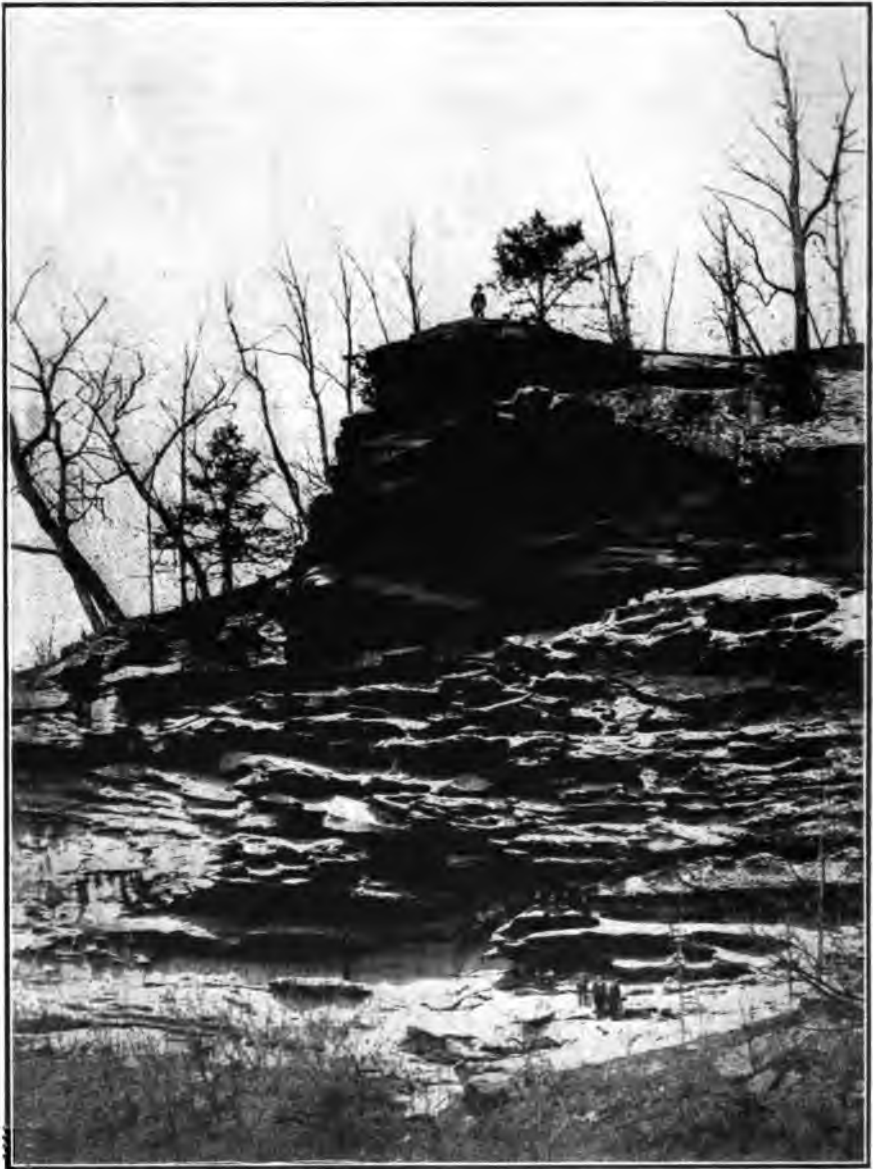


PLATE XX.—“Raven Rocks” at Uffington, Monongalia County. Here the Buffalo and Mahoning sandstones have coalesced into a massive cliff 65 feet thick.

to 120 feet below the Ames limestone and 5 to 30 feet below the Bakerstown coal, is a dark gray stratum, often carrying many marine fossils and for that reason it is frequently mistaken for the Ames. It crops over practically the same area as that outlined above for the Bakerstown coal. Its thickness and relative position in the rock column are exhibited in the sections for Morgantown and Aaron Run in Monongalia, and for Powell in Marion.

In **Monongalia** its crop is well exposed along the B. & N. R. R. grade at Morgantown, a short distance below Lock No. 10 (see Morgantown section, page 115). Here it does not appear to carry any marine fossils. Three miles southward, however, it has marine fossils in profusion at its crop near the "Raven Rocks" on the east side of Booths creek, 0.3 mile southeast of Uffington, where the following section was measured with hand-level:

**Uffington Section.**

|   | Thickness.                 | Total. |
|---|----------------------------|--------|
|   | Feet.                      | Feet.  |
| Limestone, marine fossils Ames.....                           | 5                          | 5      |
| Concealed and reds.....                                       | 94                         | 99     |
| Sandstone, flaggy, Saltsburg.....                             | 15                         | 114    |
| Shale, red and sandy.....                                     | 20                         | 134    |
| Limestone, silicious, many marine fossils,<br>Pine Creek..... | 2                          | 136    |
| Shale, green and red.....                                     | 10                         | 146    |
| Sandstone, massive, grayish white, Buffalo                    | 55                         | 201    |
| Coal, Brush Creek, 6" to.....                                 | 0                          | 201    |
| Sandstone, massive, Upper Mahoning.....                       | 25                         | 226    |
| Shale, black, (Mahoning coal horizon).....                    | 0.5                        | 226.5  |
| Concealed .....   | 5.5                        | 232    |
| Shale, gray with marine<br>and plant fossils.....20'          | } Uffington<br>shale ..... |        |
| Shale, dark, with plant<br>fossils .....14                    |                            |        |
|   | 34                         | 266    |

The bottom of the section comes near the base of the Conemaugh series as the Upper Freeport coal is reported to have been mined by stripping from the bed of Booths creek just above at the F. M. Johnson No. 1 well (341), the record of which is published on page 133 of Vol. I(A) of the State Survey reports. The well starts about 10 feet above the latter coal.

In Grant district the following section was measured at the crop of this limestone along the B. & N. R. R. grade,  $\frac{1}{4}$  mile northeast of Round Bottom:

|  | Ft. | In. |
|--|-----|-----|
| Sandstone, limy, dark green, massive, Saltsburg. | 20  | 0   |
| Shale, brown .....                               |     |     |
| Shale, gray .....                                |     |     |
| Limestone, dark gray                             |     |     |
| and hard.....0' 10"                              |     |     |
| Shale, limy .....1 8                             |     |     |
| Limestone, dark gray.1 6                         |     |     |
| Shale, yellow, gray and                          |     |     |
| limy .....5 6                                    |     |     |
| Limestone, dark gray                             |     |     |
| marine fossils.....1 0                           |     |     |
| Fire clay shale.....                             | 5   | 0   |
| Concealed to river, Pool No. 11.....             | 25  | 0   |

This is the greatest total section of this limestone observed.

In Marion a sample of this ledge was collected for analysis and the following section measured at its crop in the bed of a small stream in the southeast corner of Grant district, 0.6 mile westward from Hall Mill:

|  | Feet. |
|--|-------|
| 1. Coal, Bakerstown .....                      | 1     |
| 2. Concealed .....                             | 20    |
| 3. Limestone, yellowish                        |       |
| and hard.....3'                                |       |
| 4. Limestone, blue and                         |       |
| hard .....1                                    |       |
| (Elevation of limestone, 985' A. T., aneroid). |       |

The composition of the sample from Nos. 3 and 4 of section is reported by Messrs. Hite and Krak as follows:

|   | Per cent.    |
|---|--------------|
| Silica (Si O <sub>2</sub> ).....                      | 11.72        |
| Ferric Iron (Fe <sub>2</sub> O <sub>3</sub> ) }       |              |
| Alumina (Al <sub>2</sub> O <sub>3</sub> ).... }       | 9.43         |
| Calcium Carbonate (Ca CO <sub>3</sub> ).....          | 59.49        |
| Magnesium Carbonate (Mg CO <sub>3</sub> ).....        | 15.33        |
| Phosphoric Acid (P <sub>2</sub> O <sub>5</sub> )..... | 0.27         |
| Loss on ignition.....                                 | 2.92         |
| <b>Total .....</b>                                    | <b>99.16</b> |

Two miles and a half eastward it crops on the north hillside of Tygart Valley river, 0.5 mile northeast of Powell, at an elevation of 1320' A.T., aneroid, having there a thickness of 2 feet and carrying many marine fossils (See Powell section, page 145).

In **Taylor** this limestone is 15 inches thick at its crop along the road in the southwest border of Booths Creek district, on the west hillside of Lost run, 1.4 miles southeast of McGee. Here it carries many marine fossils and has an elevation of 1152' A.T., spirit level, 87 feet above the fossiliferous Brush Creek limestone in the bed of Lost run, 0.2 mile southeastward.

This ledge is too thin, silicious and irregular ever to have much economic value, either for road metal or agricultural lime.

**Fossil Fauna.**—A collection of fossils was made from the Pine Creek limestone from the Uffington, Colfax and McGee regions of Monongalia, Marion and Taylor counties, respectively, and forwarded to Dr. J. W. Beede as with the Ames collection for study and classification, who reports as follows thereon:

**Pine Creek Limestone Fossils:**

**Monongalia County, 0.3 mile SE of Uffington Pine Creek Limestone:**

Crinoid fragments.  
 Composita argentia.  
 Fish tooth.  
 Orthoceras? sp.  
 Productus cora.  
 Productus nebranskensis, a\*  
 Productus Cf. semireticulatus.  
 Rhombopora lepidodendroidea.

**Marion County, Robertson run., 1 mile north of Colfax:**

Ambocoelia planoconvexa.  
 Fistulipora? sp.  
 Chonetes granulifer.  
 Chonetes variolatus. Masses of these two species of Chonetes.  
 Coprolite of comminuted shells.  
 Derbya crassa?  
 Productus cora.

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\*The letter "a" means specimens of species are abundant.

**Taylor County, 1.8 miles NW of Pruntytown, Edge of Hill Road:**

Aviculopecten? sp.  
Bellerophon? sp.  
Crinoid fragments.  
Derbya crassa.  
Euomphalus catilloides.  
Lophophyllum profundum.  
Ostracoda.  
Productus cora.

At the end of this chapter is given a tabular list of fossils prepared by Dr. Beede showing species common to the Pine Creek, Ames, and Brush Creek limestones.

### **The Buffalo Sandstone.**

The **Buffalo sandstone** of White<sup>17</sup>, belonging 10 to 30 feet below the Bakerstown coal and 1 to 5 feet under the Pine Creek limestone, is a massive, grayish white and pebbly rock, ranging in thickness from 40 to 100 feet. It correlates with the First Cow Run oil sand of Cow Run, Ohio, and the Little Dunkard sand of eastern Greene county, Pa. In the area under discussion it is a prominent cliff former and generally strews the ground with large boulders wherever it crops, or makes a very pronounced steep slope around the hillsides, 60 to 90 feet above the base of the Conemaugh series. The thickness, character and relative position of this stratum in the rock column are exhibited in the sections for St. Cloud, Cassville, Morgan Run, Mont Chateau, Easton, Morgantown, Sabraton, Aaron Run, Rock Forge, Little Falls and Triune in Monongalia; for Downs and Powell in Marion; and for Grafton, Irondale, Thornton, and Stonehouse in Taylor county.

In **Monongalia** this sandstone forms the cliffs at Morgantown extending along Deckers creek from near the mouth up to the dam at the power station of the W. Va. Traction & Electric Co., the M. & K. R. R. grade at this dam running on top of the sandstone. Farther up the same stream it is the great cliff rock along the north side of the creek, northwest of Dellslow station. It is this stratum that has been quarried

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17. I. C. White Report Q, Second Geol. Survey, Penna.



PLATE XXI.—Buffalo Sandstone, Keck quarry, at Morgantown.



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along the B. & N. R. R. grade on the opposite side of the river from Morgantown, and stone from this quarry was used in the construction of the new M. E. Church and President's house at the State University in the latter town. It has also been quarried on the east side of Booths creek, 0.3 mile southeast of Uffington. A short distance above the latter quarry the well-known "Raven Rocks" are formed in this ledge which in places has cut away the underlying Brush Creek limestone, shale and coal, and coalesced with the Mahoning sandstone below (See Uffington section). It does likewise along the B. & O. R. R. grade between Scrafford and Uffington, and also along the B. & N. R. R. opposite, across the Monongahela river.

Opposite Little Falls the Buffalo sandstone has been quarried to furnish stone for the construction of Locks Nos. 12 and 13 where the quarry face is about 200 feet long and 50 to 60 feet high. One mile northwestward it forms the great cliff, 60 to 70 feet high, immediately north of Lock No. 13. Three-fourths mile above the latter lock, Reger reports this sandstone 99 feet thick, hand-leveled measurement, at an elevation of 869' L-A.T., coming 3 inches above 16 inches of Brush Creek coal.

On the southwest edge of Clinton district the great cliff rock along Whiteday creek at Whiteday (Smithtown) is formed by this sandstone.

In Taylor the Buffalo attains a fine development in the vicinity of Grafton where it makes great cliffs along the river and Threefork creek, 50 to 100 feet above B. & O. R. R. grade. It is quarried for building purposes on the opposite side of the river from Fetterman, and also on the north hillside of Threefork creek in the east edge of Grafton. These quarries will be discussed more fully on subsequent pages under "Building Stone".

### **The Brush Creek Limestone and Shale.**

From a few inches to 5 feet below the base of the Buffalo sandstone there occurs a calcareous and very fossiliferous stratum, ranging in thickness from a few inches to 3 feet, that

has been designated the **Brush Creek limestone** by I. C. White<sup>18</sup> from a stream of that name in Butler county, Pa. Between this limestone and the Brush Creek coal below, there generally comes 3 to 10 feet of dark or black shale which frequently contains marine fossils in its upper half, while in the basal portion of the same, many fossil plants occur. This shale has also been designated the **Brush Creek** on account of its close association with the coal and limestone of that name. The thickness and relative positions of this limestone and shale in the rock column are exhibited in the sections for Easton, McClaren, Sabraton and Aaron Run in Monongalia; for Powell in Marion; and for Webster, Grafton and Irondale in Taylor county.

The shale crops along the road in the southwest corner of Morgan district, Monongalia, at Scrafford, at an elevation of 860' B-A.T., where the following section was measured by Reger:

|                                       | Ft. | In. |
|---------------------------------------|-----|-----|
| Sanstone massive, Buffalo.....        |     |     |
| Slate, dark, with marine fossils..... | 10  | 0   |
| Coal, Brush Creek.....                | 0   | 6   |

On the southwest border of Grant district, both the limestone and shale crop along the B. & N. R. R. grade, 1 mile northwest of Little Falls, immediately north of Lock No. 13. Monongahela river, where the following section is exposed:

|   | Thickness. | Total. |
|---|------------|--------|
|   | Feet.      | Feet.  |
| Sandstone, massive, great cliffs, Buffalo.... | 60         | 60     |
| Shale, dark, with iron ore nodules.....       | 7          | 67     |
| Limestone, shaly, marine fossils, Brush Creek | 0.5        | 67.5   |
| Shale, dark, fossiliferous, Brush Creek.....  | 7          | 74.5   |
| Coal, Brush Creek, 9" to (898' L-A. T.).....  | 1          | 75.5   |
| Fire clay shale, gray.....                    | 20         | 95.5   |
| Iron carbonate ore, Johnstown.....            | 0.5        | 96     |
| Fire clay shale, gray.....                    | 6          | 102    |
| Sandstone, limy.....                          | 4          | 106    |
| Sandy shale.....                              | 2          | 108    |
| Fire clay shale, red at top.....              | 11         | 119    |
| Concealed to river, Pool No. 13.....          | 12         | 131    |

A short distance northwest the Buffalo sandstone has

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almost entirely cut away the intervening limestone and shale down to the Brush Creek coal. A sample for analysis was collected from the 6 inches of iron carbonate or Johnstown ore at 95.5' from the top, the composition of which is given under "Iron Ore" in Chapter XIII.

The following section is exposed at the crop of the Brush Creek shale at the road fork on the west bank of Whiteday creek, opposite Whiteday (Smithtown):

|   | Feet. |
|---|-------|
| Sandstone massive, Buffalo.....                 | 60    |
| Shale, black, marine, fossils, Brush Creek..... | 10    |
| Coal, Brush Creek (965' B-A. T.).....           | 1     |
| Fire clay shale and concealed to creek.....     | 15    |

In **Marion** the limestone crops on the southwest edge of Union district along the B. & O. R. R. grade, 1.5 miles southwest of Colfax, at an elevation of 897' A.T., spirit level, where the following section was measured:

|  | Ft. | In. |
|--|-----|-----|
| Sandstone, shaly and flaggy.....                         | 25  | 0   |
| Shale, dark, with iron ore nodules.....                  | 20  | 0   |
| Limestone, shaly, many marine fossils, Brush Creek ..... | 3   | 0   |
| Coal, Brush Creek.....                                   | 1   | 1   |
| Fire clay shale .....                                    |     |     |

Three feet of this black shale with marine fossils is exposed at crop on the opposite side of the river from Colfax, immediately over 14½ inches of Brush Creek coal, at an elevation of 921' A.T., spirit level. Its crop is also exposed along the north hillside of Tygart Valley river, 0.5 mile northeast of Powell (See Powell section, page 145).

In **Taylor** the crop of the limestone is well exposed in the bed of Lost run in the southwest border of Booths Creek district, 0.5 mile above the mouth of Brush run, at an elevation of 1065' A.T., aneroid, where it is 3 inches thick and carries many marine fossils.

On the western edge of Courthouse district, Reger measured the following section at the crop of the limestone along the west bank of Tygart Valley river, 1.5 miles south of Grafton, in an old railroad cut:

|  | Ft. | In. |
|--|-----|-----|
| Shale, brown.....                                  | 15  | 0   |
| Limestone, marine fossils, prolific, Brush Creek.. | 0   | 6   |
| Slate, black, Brush Creek.....                     | 4   | 0   |

**Fossil Fauna.**—Collections of marine fossils were made from this limestone and shale as with the Ames and Pine Creek, in Monongalia, Marion and Taylor counties, and the specimens forwarded to Dr. J. W. Beede for study and classification, who reports as follows thereon:

**Brush Creek Limestone Fossils\***

**Monongalia County, Lock No. 13, B. & N. R. R. Grade:**

Astartella gurleyi.  
 Astartella vera.  
 Aviculopecten hertzeri.  
 Aviculopecten Cf. interlineatus.  
 Aviculopecten Cf. Maccoyi.  
 Aviculopecten sp.  
 Bellerophon percarinatus.  
 Bullimorpha 2 sp.  
 Bellerophon Cf. stevensanus.  
 Composita argentia.  
 Crinoid fragments.  
 Euomphalus catilloides.  
 Gastropod.  
 Leda bellistriata.  
 Leda attenuata.  
 Lophophyllum profundum.  
 Nucula sp.  
 Nucula sp.  
 Nucula parva.  
 Orthonema sp.  
 Orthoceras sp.  
 Ostracoda. Many species.  
 Patellostium montfortianum.  
 Pelecypod sp.  
 Pelecypod sp.  
 Plagioglypta meekana.  
 Pleurotomaria? sp.  
 Pleurophorus sp.  
 Productus cora.  
 Spirifer cameratus.  
 Tainoceras occidentalis?  
 Worthenia Cf. speciosa.  
 Yoldia sp.

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\*The letter "a" means that specimens of species were abundant; the letter "c", common; and the letter "r", rare.

Whiteday (Smithtown), West bank of Whiteday Creek:  
(Fossils fragmentary and poorly preserved).

*Ambocoelia planoconvexa*.  
*Astartella?* sp.  
*Astartella gurleyi*.  
*Aviculopecten hertzeri*.  
*Bullmorpha?* sp.  
*Euomphalus catilloides*, c.  
*Leda bellistriata*.  
*Lingula umbonata*.  
 Nautiloid.  
*Nucula parva*.  
*Orthonema?* sp.  
*Orthoceras?* sp.  
 Ostracoda, six or eight species.  
*Patellostium?* sp.  
*Pelecypod* sp.  
*Plagioglypta meekana*.  
*Productus cora*.

Marion County, West bank Tygart River at Colfax:

*Ambocoelia planoconvexa*.  
*Astartella gurleyi*.  
*Astartella vera?*  
*Aviculopecten hertzeri*, c.  
*Bellerophon* Cf. *stevensanus*.  
*Bellerophon percarinatus*.  
*Bullmorpha?* sp.  
*Chonetes granulifer*, a.  
*Chonetes variolatus*.  
*Derbya crassa*.  
*Euphemus carbonarius*.  
*Euomphalus catilloides*, a.  
*Leda attenuata*.  
*Lophophyllum profundum*.  
*Marginifera splendens*, c.  
*Nucula parva*, c.  
*Nucula ventricosa*.  
*Orothoceras*, 1 or 2 species.  
 Ostracoda, 5 or 6 species.  
*Patellostium montfortianum*.  
*Plagioglypta?*  
*Pleurotomaria* Cf. *brazoensis*.  
*Pleurotomaria*, 2 species.  
*Pelecypod*, sp.  
*Pleurophorus* sp.  
*Schizodus suncircularis*, c.  
*Soleniscus brevis*.  
*Tainoceras occidentalis?*  
*Worthenia* Cf. *speciosa*, c.

Taylor County, 1¼ Miles NW of Pruntytown, bed of Lost run:

*Aclisina* sp.  
*Astartella gurleyi*.

*Astartella vera*, a.  
*Aviculopecten?* sp.  
*Bellerophon Cf. stevensanus*.  
*Bellerophon percarinatus*, a.  
*Bellerophon* sp.  
*Bulimorpha* sp.  
*Chonetes* sp.  
*Composita argenticola*.  
 Crinoid fragments.  
*Edmondia?* sp.  
*Orothoceras* sp.  
*Parallelodon* sp.  
*Patellostium montfortianum*.  
*Plagioglypta?* sp.  
*Pleurotomaria* 2 sp.  
*Rhomborhynchus lepidodendroidea*.  
*Soleniscus brevis*.  
*Soleniscus* sp.  
*Trilobite glabella*.

**Grafton, 2 Miles south of West Bank of Tygart Valley River:**

*Acanthopecten carboniferus*.  
*Bellerophon percarinatus*.  
*Bellerophon Cf. stevensanus*.  
*Chonetes* sp.  
*Composita argenticola*.  
 Crinoid fragments.  
*Pleurotomaria* sp.  
*Phillipsia?* sp.  
*Productus nebraskensis*.  
*Strophalosia* sp.  
*Tainoceras occidentalis?*

At the end of this chapter is given a tabular list, prepared by Dr. Beede, of the species common to the Brush Creek, Ames and Pine Creek limestones.

**The Brush Creek Coal.**

The **Brush Creek coal** of White<sup>19</sup>, belonging 5 to 15 feet below the Brush Creek limestone and at the base of the Brush Creek shale, is a thin—6 to 18 inches—single-bedded vein of wide distribution. Its crop follows roughly the same area as that outlined for the Upper Freeport coal on Map II, since it belongs only 75 to 90 feet above the base of the Conemaugh series. Its thickness and relative position in the rock column are exhibited in the sections for VanVoorhis, Morgan Run,

19. Report Q, Second Geol. Survey, Penna.







**PLATE XXII(a)—President's Home, West Virginia University, built of Buffalo Sandstone.**



**PLATE XXII(b)—Methodist Episcopal Church at Morgantown, built of Buffalo Sandstone.**

Easton, McClaren, Morgantown and Rock Forge in Monongalia; for Powell in Marion; and for Webster, Grafton, Thornton and Stonehouse in Taylor county.

In **Monongalia** this vein was once stripped out of the bed of the Monongahela river at Morgantown during low water periods before the construction of locks and dams on the latter stream. Southwestward along the axis of the Indiana anticline, this coal rises rapidly and crops near the road fork at the Standard Oil pump station (Scrafford) at an elevation of 860' A.T., aneroid, where it is only 6 inches thick, directly below the fossiliferous Brush Creek shale, and 10 feet below the Buffalo sandstone. It is 12 inches thick at its crop in the road a short distance west of the residence of Arlington Field, 1.5 miles northeast of Dellslow, at an elevation of 1350' A.T. On the southwest border of Grant district this coal is 9 to 12 inches thick at its crop along the B. & N. R. R. grade immediately north of Lock No. 13, as shown in the section given above under the discussion of the Brush Creek limestone and shale.

The following section was measured by Reger at its crop along the road on the southwest edge of Clinton district, 0.4 mile south of Whiteday, near the Ed. Watson No. 1 well (344):

|   | Ft. | In. |
|---|-----|-----|
| Shale, dark fossiliferous.....                  | 8   | 0   |
| Coal, Brush Creek (1005' B-A. T.).....          | 1   | 6   |
| Shale .....                                     | 15  | 0   |
| Sandstone, Upper Mahoning, to Watson No. 1 well | 15  | 0   |

In **Marion** this coal crops on the northeast edge of Grant district, near the west end of the bridge over Tygart Valley river at Colfax, at an elevation of 920' A.T., spirit level, where a sample of coal was collected for analysis and the following section measured:

**Colfax Prospect, Brush Creek Coal—No. 72 on Map II.**

|  | Ft. | In. |
|--|-----|-----|
| Shale, sandy.....                              | 15  | 0   |
| Shale, dark, with iron ore nuggets.....        | 10  | 0   |
| Shale, black, marine fossils, Brush Creek..... | 2   | 6   |
| Coal, Brush Creek.....                         | 1   | 2½  |
| Fire clay shale, Brush Creek.....              | 10  | 0   |
| Sandstone, Mahoning, to river.....             |     |     |

The composition, calorific value and fuel ratio of the sample are given under **No. 72** (Laboratory No. 572H) in the table of coal analyses. Two miles southeastward the crop of this coal is exposed along the north hillside of Tygart Valley river, 0.5 mile northeast of Powell where it is 8 to 12 inches thick (See Powell section, page 145).

In **Taylor** the following section was measured at an opening in this bed in the northwest border of Fetterman district, 1.3 miles northeast of Coffman:

#### L. D. Phillips Mine, Brush Creek Coal.

|   | Ft. | In. |
|---|-----|-----|
| Sandstone, massive, Buffalo.....              | 40  | 0   |
| Concealed .....                               | 10  | 0   |
| Slate, black, fossil plants, Brush Creek..... | 5   | 0   |
| Coal, Brush Creek.....                        | 1   | 4½  |
| Fire clay shale.....                          |     |     |
| (Elevation of coal, 1190' B.A. T.)            |     |     |

This opening furnished domestic fuel for Mr. Phillips.

In Booths Creek district, this coal has been opened on the land of John Jeffries at the west edge of the private road on Jack run, 1 mile east of McGee, at an elevation of 1185' A.T., aneroid, where the following section was measured:

|  | Ft. | In. |
|--|-----|-----|
| 1. Concealed .....                               |     |     |
| 2. Shale, black, fossiliferous, Brush Creek..... | 3   | 6   |
| 3. Coal, good Brush Creek.....                   | 1   | 6   |
| 4. Fire clay shale.....                          | 0   | 3   |
| 5. Concealed .....                               | 20  | 0   |
| 6. Sandstone, massive, coarse, pebbly, Mahoning  | 50  | 0   |

Three-fourths mile southward, near the road fork at the mouth of Rush run, the Brush Creek coal—16 inches thick—crops along the road at an elevation of 1076' A.T., aneroid, 76 feet by hand-level below the fossiliferous Pine Creek limestone. As mentioned on a preceding page, the fossiliferous Brush Creek limestone crops in the bed of Lost run, 0.3 mile southwestward.

In the northwest corner of Knottsville district, Reger measured the following section at the crop of this coal near the **Newton Grimes No. 1 well (722)**, 0.5 mile southeast of Grafton:

|   | Ft. | In. |
|---|-----|-----|
| Sandstone, massive, Buffalo.....              | 40  | 0   |
| Shale, black, fossil plants, Brush Creek..... | 4   | 0   |
| Coal, Brush Creek.....                        | 0   | 6   |
| Concealed to Grimes No. 1 well (722).....     | 10  | 0   |
| Sandstone, massive; Upper Mahoning.....       | 30  | 0   |
| Shale, gray.....                              |     |     |
| (Elevation of coal, 1120' A. T., aneroid).    |     |     |

The same coal is 10 inches thick at its crop at the foot of the hill road on the west bank of the Tygart Valley river, 1 mile northeast of Webster, at an elevation of 1020' A.T. aneroid.

In the southeastern edge of Courthouse district this vein crops along the road at the intersection of Pleasant creek with the Taylor-Barbour county line, at an elevation of 1155' A.T., aneroid, where the following section is exposed:

|                                    | Ft. | In. |
|------------------------------------|-----|-----|
| Sandstone, Buffalo.....            | 40  | 0   |
| Concealed .....                    | 15  | 0   |
| Coal, slaty, Brush Creek.....      | 0   | 6   |
| Fire clay shale.....               | 3   | 0   |
| Sandstone, Mahoning, to creek..... | 30  | 0   |

Northeastward in the southern point of Knottsville district this coal—8 inches thick—crops in the road 0.5 mile north of Cecil, at an elevation of 1245' A.T., aneroid, about 110 feet below the Bakerstown coal at the Shroyer mine—No. 71 on Map II. Eight-tenths mile northeast of Hiram, an abandoned opening occurs in this coal on the land of Geo. McCartney Heirs, near the road fork on the north side of Glade run, at an elevation of 1440' A.T. The opening had fallen shut; hence, no section was obtained.

In the northeastern corner of Knottsville district the Brush Creek coal was once opened on the land of John W. Thomas, 0.6 mile southwest of Eby, at an elevation of 1525' A.T., aneroid, 175 feet below the Harlem coal. Mr. Thomas reports the bed 30 inches thick with 3 or 4 inches of hard coal on top.

From the foregoing data it is readily observed that the Brush Creek coal is too thin, impure and irregular to be classed as a minable bed.

At many points in the three counties there occurs a fairly

pure fire clay shale immediately below the last coal described, ranging in thickness from 5 to 10 feet. A sample of this clay was collected for analysis and the following section measured at its crop near the foot of the hill road on the west bank of Tygart Valley river, 1 mile northeast of Webster :

|   | Ft. | In. |
|---|-----|-----|
| Shale .....                                   | 4   | 0   |
| Slate, black, fossil plants, Brush Creek..... | 4   | 0   |
| Coal, Brush Creek.....                        | 0   | 10  |
| Fire clay shale, good.....                    | 10  | 0   |
| (Elevation of coal, 1020' A. T., aneroid).    |     |     |

The composition of the sample is reported by Messrs Hite and Krak as follows:

|   | Per cent. |
|---|-----------|
| Silica (Si O <sub>2</sub> ).....                      | 53.54     |
| Ferric Iron (Fe <sub>2</sub> O <sub>3</sub> ).....    | 4.64      |
| Alumina (Al <sub>2</sub> O <sub>3</sub> ).....        | 26.34     |
| Lime (Ca O).....                                      | 0.10      |
| Magnesia (Mg O).....                                  | 0.70      |
| Soda (Na <sub>2</sub> O).....                         | 0.39      |
| Potassa (K <sub>2</sub> O).....                       | 3.76      |
| Titanium (Ti O <sub>2</sub> ).....                    | 0.59      |
| Phosphoric Acid (P <sub>2</sub> O <sub>5</sub> )..... | 0.20      |
| Moisture .....  | 1.87      |
| Loss on ignition .....                                | 7.68      |
| Total .....   | 99.71     |

The results show a clay adapted to the manufacturing of building and paving brick.

### The Mahoning Sandstone Stage.

At 5 to 25 feet below the Brush Creek coal there belongs almost universally a massive sandstone group, frequently in one massive solid ledge, 80 to 100 feet thick, but sometimes separated into two sandstones by an intervening coal and an underlying fire clay; so that when all the members are represented, the Mahoning stage is made up of the following succession:

Upper Mahoning sandstone.  
 Mahoning coal.  
 Thornton fire clay.  
 Lower Mahoning sandstone

**The Mahoning Sandstones.**—The sandstone members of this stage along with the overlying Buffalo sandstone play a conspicuous part in shaping the topography of the area; in fact, as mentioned under the description of the latter stratum, the Mahoning and Buffalo sometimes coalesce into one great unbroken cliff as exhibited along the B. & O. R. R. grade between Morgantown and Uffington, Monongalia county. The "Big Dunkard sand" of the oil and gas well drillers belongs at this horizon. Their crop follows closely the area outlined on Map II for the crop of the Upper Freeport coal; and their thickness, character and relative position in the rock column are exhibited in the sections for Morgan Run, Morgantown, Sabraton, Aaron Creek, Rock Forge, Little Falls and Triune in Monongalia; for Glover Gap, Whetstone Run, Downs, Montana Mines and Powell in Marion; and for Grafton, Irondale, Thornton and Cecil in Taylor county.

In **Monongalia** the Mahoning rises above Cheat river at Ices Ferry, and is there represented by the prominent cliff at the west end of the highway bridge over the latter stream. The rapid southeast rise of the strata on the western slope of the Chestnut Ridge anticline from the latter point causes these sandstones to pass into the air over the high mountain summits within two miles. Along the Monongahela it crops above river level along the crest of the Indiana anticline at Uffington and Little Falls as exhibited in the sections on preceding pages for these points. The wing walls of the dam at Lock No. 13 on the latter stream, one mile northwest of Little Falls, rest on the Mahoning sandstones.

In **Marion** these sandstones first rise above drainage on Tygart Valley river at Colfax as exhibited in the section there under the description of the Brush Creek coal. Southeastward along this stream to near Hammond they have coalesced into one great unbroken cliff—60 feet high—forming the valley walls (See Powell section, page 145).

In **Taylor** the Mahonings attain the same development on the opposite side of the river from the last locality mentioned. The rapid dip of the strata on the eastern slope of the Chestnut Ridge anticline causes these sandstones to pass below this stream a short distance above the mouth of Wickwire run,

again to emerge at Grafton. The "Black Falls" or shoals in the river, south of Grafton and 0.5 mile below the mouth of Scab run, are formed by the Mahoning, where it is massive, gray, hard and pebbly, weathering to a brownish color. One-half mile southward it has been quarried to a small extent at the mouth of Scab run.

**The Mahoning Coal.**—The Mahoning coal of White<sup>20</sup>, belonging immediately below the Upper Mahoning sandstone, was not observed either at crop or in the logs of several diamond drill borings penetrating the same; however, a streak of dark shale and fire clay was noted at this horizon along the B. & O. R. R. grade between Scrafford and Uffington in Monongalia.

**The Thornton Fire Clay.**—The Thornton fire clay of White<sup>21</sup>, belonging immediately under the Mahoning coal and 30 to 40 feet above the base of the Conemaugh series, is very irregular in thickness, very frequently absent entirely, but when present is fairly pure. It attains its best development at Thornton, its type locality in eastern Taylor county, where it has been mined quite extensively by the Thornton Fire Brick Company to furnish the raw clay for their plant. Here the clay has apparently entirely replaced the Lower Mahoning sandstone (See Thornton section, page 154). Samples were collected at Thornton by Reger for analysis, the composition and properties of which are given in detail under "Clay" on a subsequent page.

This fire clay, several feet in thickness and of good quality, is finely exposed along the bed of Threeforks creek in western Preston county, 0.2 mile southwest of Brown's Mills, 45 feet below the Brush Creek coal and immediately under the Upper Mahoning sandstone; hence, in this portion of the State, it appears quite persistent. This formation furnishes part of the raw clay used in the brick plant at Colfax, Marion. There Reger collected a sample for analysis, the composition of which is given under "Clay" in a subsequent chapter.

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20. I. C. White, Bull. No. 65, U. S. G. Survey, p. 94; 1891.

21. I. C. White, Vol. II, W. Va. Geol. Survey, pp. 322-323; 1903.

### The Uffington Shale.

The basal formation of the Conemaugh series is the **Uffington shale** so designated by I. C. White<sup>22</sup> from a town of that name in Monongalia county, where it is a dark, sandy and fossiliferous shale, varying in thickness from 20 to 40 feet and occupying the interval between the Lower Mahoning sandstone and the Upper Freeport coal. Here the shale contains marine fossils as well as many plant remains, and it was from this locality that most of the specimens were collected by J. J. Stevenson that are listed on pages 324-325 of Vol. II. of the State Survey reports as follows:

#### List of Fossils from Uffington Shales Near Morgantown.

- \*Crinoidal columns.
- Erisocrinus. Undetermined species.
- \*Deltopecten carbonarius Stevenson sp.
- Allorisma. Undetermined species.
- \*Nucula ventricosa Hall.
- †Nucula anodontoides Meek.
- \*Leda atetnuata Stevenson sp.
- †Yoldia carbonaria Meek.
- †Yoldia stevensoni Meek.
- \*Schizodus. Undetermined species.
- \*Edmondia aspenwalensis Meek.
- Astartella. Undetermined species.
- Sphaerodoma primigenia Conrad.
- \*Soleniscus brevis Hall.
- Sphaerodoma? Undetermined species.
- Bullimorpha? peracua Meek and Worthen.
- \*Euomphalus catilloides Conrad.
- \*Patellostium montfortianus Norwood and Pratten.
- \*Bellerophon percarinatus Conrad.
- \*Euphemus carbonarius Cox.
- Bucanopsis meekiana Swallow.
- \*Pleurotomaria grayvillensis Norwood and Pratten.
- \*Orthoceras cribrosum Geinitz.
- \*Tainoceras occidentalis Swallow.
- \*Phillipsia sangamonensis Meek and Worthen.
- \*Productus nebrascensis Owen.
- \*Productus cora D'Orbigny.

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22. Vol. II, W. Va. Geol. Survey, pp. 323-325, 1903.

\*Species known to range through the whole of the Coal Measures in the West, even into the upper beds at Nebraska City, Nebraska, referred by Profs. Marcou and Geinitz to the Permian or so-called Dyas

†New species.



\**Composita argentia* Stevenson. Presenting all the usual varieties. Productus. Species undetermined. Very small, concentrically wrinkled.

\**Ambocoelia planoconvexus* Shumard.

\**Spirifer cameratus* Morton.

*Aviculapecten?* Undetermined species. Probably *Deltopecten occidentalis* Shumard.

\**Derbya crassus* Meek and Hayden.

The crop of this shale should follow very closely the same area as that outlined for the Upper Freeport coal on Map II. Its thickness and relative position in the rock column are exhibited in the sections for VanVoorhis, Aaron Creek and Uffington in Monongalia, and for Stonehouse in Taylor county. It is not at all persistent, as often the Lower Mahoning sandstone lies in immediate contact with the Upper Freeport coal. At Thornton the overlying Thornton fire clay has replaced this shale entirely.

#### FOSSIL FAUNA, CONEMAUGH SERIES.

As mentioned on preceding pages under the descriptions of the Ames, Pine Creek and Brush Creek limestones, a tabular list of the species collected from these formations has been prepared by Dr. Beede, omitting some of the uncertain and undetermined species, which would increase the total number shown in the table. This list which follows exhibits a total of 71 different species many of which are common to all three of the limestones. The Ames and Brush creek rank about equal in the variety of forms shown therein, both revealing a greater diversity of animal life than the Pine Creek:

| Marine Fossils from Three Conemaugh Limestones in the Monongalia-Marion-Taylor Area. | Ames. | Pine Creek. | Brush Creek. |
|--|-------|-------------|--------------|
| <i>Endothyra</i> sp.....   | x     | ..          | ..           |
| <i>Lophophyllum profundum</i> .....  | ..    | x           | x            |
| Crinoid fragments.....   | a     | a           | x            |
| <i>Serpula?</i> sp.....  | x     | ..          | ..           |
| Bryozoan sp.....   | ..    | x           | ..           |
| <i>Rhombopora lepidodendroidea</i> .....   | ..    | x           | x            |
| <i>Ambocoelia planoconvexa</i> .....   | a     | x           | c            |
| <i>Chonetes granulifer</i> .....   | c     | x           | c            |
| <i>Chonetes variolatus</i> .....   | r     | x           | x            |
| <i>Composita argentia</i> .....  | a     | x           | x            |
| <i>Derbya crassa</i> .....   | c     | x           | x            |
| <i>Lingula umbonata</i> .....  | ..    | ..          | r            |

|  | Ames. | Pine<br>Creek. | Brush<br>Creek. |
|--|-------|----------------|-----------------|
| <i>Marginifera splendens</i> .....           | ..    | ..             | C               |
| <i>Productus cora</i> .....                  | X     | X              | X               |
| <i>Productus nebraskensis</i> .....          | C     | X              | ..              |
| <i>Productus pertenuis??</i> .....           | X     | ..             | ..              |
| <i>Productus Cf. semireticulatus</i> .....   | ..    | X              | ..              |
| <i>Rhipidomella pecosi</i> .....             | X     | ..             | ..              |
| <i>Spirifer cameratus</i> .....              | X     | ..             | X               |
| <i>Strophalosia sp.</i> .....                | X     | ..             | ..              |
| <i>Allorisma geinitzi??</i> .....            | F     | ..             | ..              |
| <i>Astartella gurleyi</i> .....              | C     | ..             | X               |
| <i>Astartella vera</i> .....                 | F     | ..             | X               |
| <i>Aviculopecten hertzeri</i> .....          | ..    | ..             | C               |
| <i>Aviculopecten Cf. interlineatus</i> ..... | ..    | ..             | X               |
| <i>Aviculopecten sp.</i> .....               | F     | ..             | ..              |
| <i>Aviculopecten? sp.</i> .....              | ..    | ..             | X               |
| <i>Aviculopinna americana?</i> .....         | F     | ..             | ..              |
| <i>Deltopecten McCoyi</i> .....              | ..    | ..             | ?               |
| <i>Deltopecten occidentalis</i> .....        | X     | ..             | ..              |
| <i>Edmondia aspenwallensis?</i> .....        | X     | ..             | ..              |
| <i>Leda bellistriata</i> .....               | X     | ..             | X               |
| <i>Leda attenuata</i> .....                  | C     | ..             | X               |
| <i>Myalina subquadrata</i> .....             | X     | ..             | ..              |
| <i>Nucula parva</i> .....                    | C     | ..             | C               |
| <i>Nucula sp.</i> .....                      | X     | ..             | X               |
| <i>Nucula ventricosa</i> .....               | ?     | ..             | X               |
| <i>Parallelodon tenuistriata?</i> .....      | ..    | ..             | X               |
| <i>Pleorophorus oblongus?</i> .....          | F     | ..             | ..              |
| <i>Schizodus suborbicularis</i> .....        | ..    | ..             | X               |
| <i>Solenomya trapezoides?</i> .....          | F     | ..             | ..              |
| <i>Yoldia sp.</i> .....                      | X     | ..             | ..              |
| <i>Aclisina sp.</i> .....                    | X     | ..             | ..              |
| <i>Aclisina swallowana</i> .....             | X     | ..             | ..              |
| <i>Bellerophon percarinatus</i> .....        | X     | ..             | C               |
| <i>Bellerophon stevensanus</i> .....         | F     | ..             | ..              |
| <i>Bellerophon sp.</i> .....                 | ..    | ..             | X               |
| <i>Bulimorpha chrysalis</i> .....            | X     | ..             | ..              |
| <i>Bulimorpha sp. a.</i> .....               | X     | ..             | X               |
| <i>Bulimorpha sp.</i> .....                  | X     | ..             | ..              |
| <i>Euomphalus catilloides</i> .....          | X     | X              | C               |
| <i>Euphemus carbonarius</i> .....            | X     | X              | C               |
| <i>Loxonema scitulum</i> .....               | F     | ..             | ..              |
| <i>Loxonema rugosum</i> .....                | F     | ..             | ..              |
| <i>Loxonema semicostatum</i> .....           | F     | ..             | ..              |
| <i>Orthonema quadricarinatum</i> .....       | X     | ..             | ..              |
| <i>Orthonema Cf. subtaeniatum</i> .....      | F     | ..             | F               |
| <i>Orthonema? sp.</i> .....                  | F     | ..             | F               |
| <i>Patellostium Montfortianum</i> .....      | C     | ..             | X               |
| <i>Plagioglypta meekana</i> .....            | ..    | ..             | X               |
| <i>Pleurotomaria Cf. brazoensis</i> .....    | X     | ..             | X               |
| <i>Soleniscus brevis</i> .....               | X     | ..             | X               |
| <i>Soleniscus paludinaeformis</i> .....      | X     | ..             | ..              |
| <i>Sphaerodoma primingenia?</i> .....        | X     | ..             | ..              |
| <i>Worthenia Cf. speciosa</i> .....          | X     | ..             | C               |
| <i>Orthoceras rushensis?</i> .....           | X     | ?              | X               |
| <i>Tainoceras occidentalis</i> .....         | ?     | ..             | ?               |

|                         | Ames. | Pine<br>Creek. | Brush<br>Creek. |
|-------------------------|-------|----------------|-----------------|
| Nautiloid .....         | ..    | ..             | r               |
| Ostracoda .....         | x     | ..             | x               |
| Phillipsia major? ..... | ..    | ..             | ?               |
| Fish tooth.....         | ..    | r              | ..              |

"In the right hand columns of the above list, the "a" signifies that the specimens of the species were abundant; the "c", that they were common, that is, present in numbers; the "r" and "x", rare to fairly numerous."

# CHAPTER VIII.

## STRATIGRAPHY—ALLEGHENY SERIES.

The Allegheny series begins at top with the Upper Freeport coal and extends down in the rock column to the top of the Homewood sandstone. An interesting account of the same in West Virginia is given by I. C. White on pages 333-341 of Vol. II of the State Survey reports. The crop of these rocks in the area under discussion, as shown in detail on Map II, is confined to the eastern portions of Monongalia and Marion counties, and the central and eastern portions of Taylor. Their thickness ranges from 220 to 275 feet.

### SECTIONS.

The following is a general section of the Allegheny in West Virginia:

#### General Section, Allegheny Series in West Virginia.

|  | Thickness. | Total. |     |
|--|------------|--------|-----|
|  | Feet.      | Feet.  |     |
| Coal, Upper Freeport.....  | 5          | 5      |     |
| Fire clay, Bolivar.....  | 10         | 15     |     |
| Limestone, Upper Freeport.....   | 5          | 20     |     |
| Sandstone, Upper Freeport, containing some times Middle Freeport coal..... | 40         | 60     |     |
| Coal, Lower Freeport.....  | 2          | 62     | 62' |
| Fire clay and shale.....   | 3          | 65     |     |
| Limestone, Lower Freeport.....   | 5          | 70     |     |
| Sandstone, Lower Freeport, upper division..                                | 40         | 110    |     |
| Coal, Upper Kittanning.....  | 4          | 114    | 52' |
| Fire clay shale.....   | 6          | 120    |     |
| Limestone, Johnstown (cement).....   | 4          | 124    |     |
| Fire clay, Hardman.....  | 6          | 130    |     |
| Sandstone, Lower Freeport, lower division..                                | 30         | 160    |     |
| Coal, Middle Kittanning.....   | 2          | 162    |     |
| Shale, sandy.....  | 18         | 180    |     |
| Coal, Lower Kittanning.....  | 5          | 185    | 71' |
| Fire clay, Lower Kittanning.....   | 5          | 190    |     |
| Shale, with iron ore nuggets.....  | 30         | 220    |     |

|                                       | Thickness.<br>Feet. | Total.<br>Feet. |     |
|---------------------------------------|---------------------|-----------------|-----|
| Limestone, Vanport (Ferriferous)..... | 2                   | 222             |     |
| Sandstone, Clarion.....               | 20                  | 242             |     |
| Coal, Clarion.....                    | 3                   | 245             |     |
| Fire clay, Clarion.....               | 5                   | 250             | 55' |
| Sandstone, massive, Homewood.....     |                     |                 |     |

The succession and character of the strata of the Allegheny series in this area are exhibited in the general sections given in Chapter IV and the two following widely separated sections measured at crop:

### Dellslow Section, Allegheny Series.

|   | Thickness.<br>Feet.                          | Total.<br>Feet. |       |
|---|--|-----------------|-------|
| Coal, bony.....2' 6"  | } (13' 6")<br>Upper<br>Freeport<br>coal .... | 13.5            | 13.5  |
| Coal, soft.....3 0  |  |                 |       |
| Slate, dark gray, 2" to.0 3   |  |                 |       |
| Coal .....1 0   |  |                 |       |
| Slate, dark gray, 1" to.0 2   |  |                 |       |
| Coal .....0 2   |  |                 |       |
| Shale, gray.....5 0   |  |                 |       |
| Coal .....0 10  |  |                 |       |
| Shale, dark gray.....0 2  |  |                 |       |
| Coal .....0 5   |  |                 |       |
| Fire clay, Bolivar.....   | 3  | 16.5            |       |
| Limestone, silicious and shaly, Upper Freeport .....                | 5.5  | 22              |       |
| Shale .....   | 5  | 27              |       |
| Concealed .....   | 31   | 58              |       |
| Shale, sandy, with thin sandstones.....                             | 15   | 73              |       |
| Coal, Lower Freeport, 6" to.....                                    | 1  | 74              | 74'   |
| Fire clay shale.....  | 5  | 79              |       |
| Sandstone, with shale layers.....                                   | 6  | 85              |       |
| Shale, gray.....  | 4  | 89              |       |
| Limestone, silicious, broken, Lower Freeport, 0' to.....            | 3  | 92              |       |
| Sandstone, massive, lenticular, 1' to.....                          | 4  | 96              |       |
| Shale, with thin flaggy sandstones and iron ore nuggets.....        | 14   | 110             |       |
| Black sandy slate.....  | 0.1  | 110.1           |       |
| Coal, Upper Kittanning.....   | 0.7  | 110.8           | 36.8' |
| Fire clay and gray shale.....                                       | 3.2  | 114             |       |
| Sandstone, massive, limy, nodular.....                              | 4  | 118             |       |
| Shale, dark gray.....   | 7  | 125             |       |
| Coal, slaty at bottom, Middle Kittanning....                        | 1  | 126             | 153'  |
| Shale, dark, sandy, laminated with many small iron ore nuggets..... | 4  | 130             |       |
| Shale, dark gray.....   | 7  | 137             |       |
| Slate, black.....   | 2  | 139             |       |
| Shale, sandy and dark.....  | 2  | 141             |       |
| Concealed .....   | 5  | 146             |       |
| Coal (old digging fallen shut), Lower Kittanning .....              | 4  | 150             | 24'   |
| Concealed .....   |  |                 |       |

In the above section that portion above the Upper Kittanning coal was measured with hand-level along the Morgantown & Kingwood Railroad grade west of Dellslow station, and the lower portion from exposures along the same grade south of the latter station. Owing to the intervening ravine and rapid southeast dip of the strata it was quite difficult to connect the two parts of the section.

The following section was measured with aneroid by Reger eastward in descending order to near the residence of Granville Brown, near Halleck, Monongalia county, along the rapid dip of the strata; hence, thicknesses of formations and intervals are greater than they should be:

**Section 1.4 Miles N. of Halleck, Allegheny Series.**

|   | Thickness. | Total. |
|---|------------|--------|
|   | Feet.      | Feet.  |
| Coal, Upper Freeport, concealed, but thickness supplied by Granville Brown..... | 3          | 3      |
| Concealed .....   | 90         | 93     |
| Coal opening, thickness concealed, Lower Freeport .....                         | 0          | 93     |
| Concealed with sandstone.....   | 65         | 158    |
| Coal, thickness concealed, Upper Kittanning                                     | 0          | 158    |
| Concealed .....   | 43         | 201    |
| Shale, dark.....  | 9.5        | 210.5  |
| Coal .....1' 6" } Lower Kittanning  |            |        |
| Slate, black....0 3 } coal .....  | 3.5        | 214    |
| Coal, soft.....0 8 } (Elevation, 1800' B-A. T.)                                 |            |        |
| Slate and concealed.....  | 45         | 259    |
| Iron ore, Buhrstone 12" to.....   | 1.5        | 260.5  |
| Concealed .....   | 9.5        | 270    |
| Sandstone, massive, white, Homewood.....  |            |        |

DESCRIPTION OF ALLEGHENY FORMATIONS.

**The Upper Freeport Coal.**

The topmost formation of the Allegheny series is the **Upper Freeport coal bed** which was designated by the First Geol. Survey of Penna. from the town of Freeport in western Pennsylvania, where it is a multiple-bedded seam, a characteristic feature that accompanies it everywhere in West Virginia. As shown in detail on Map II its crop is confined to the eastern portions of Monongalia and Marion counties, and the central and eastern portions of Taylor. In this portion of the

State the coal has a peculiar structure which so distinctly characterizes it that the bed may be identified thereby with a fair degree of certainty. A series of parting slates or shales subdivide the vein into several definite members which may be grouped as follows:

- |                          |                            |
|--------------------------|----------------------------|
| 1. Top coal.             | 4. Lower bench—Mining Ply. |
| 2. Main bench.           | 5. Parting—Big Slate.      |
| 3. Parting—Little Slate. | 6. Bottom coal.            |

At present there are three commercial mines in the area, and all are located along Deckers creek in Monongalia, being driven directly on the crop of the bed. The following is a general type section of the coal as exhibited at these mines:

|  | Ft. | In. |
|--|-----|-----|
| 1. Coal, hard, sulphurous "top".....                                 | 1   | 6   |
| 2. Coal, soft, "main bench".....                                     | 2   | 10  |
| 3. Slate, "little" .....   | 0   | 2   |
| 4. Coal, soft, with thin slate 2" above bottom,<br>"mining ply"..... | 1   | 3   |
| 5. Slate, dark gray, "big slate" 12" to.....                         | 5   | 0   |
| 6. Coal, hard, sulphurous, "bottom".....                             | 1   | 3   |
| Total.....   | 12  | 0   |

The "main bench" and "mining ply" are much lower in sulphur than the other portions of the bed, and it is from these divisions that the high grade coking coal is taken.

As a minable seam this vein appears to be confined almost entirely to the eastern portion of the area, and on Map II the "Approximate western boundary line where the Upper Freeport coal of commercial thickness and purity disappears" is shown by a heavy line of dots in blue. There may be small areas of this bed of minable thickness to the west of this line, but they will prove extremely limited in extent, as revealed both from crop and the borings of a great number of wells for oil and gas. Likewise, there may prove to be some small areas to the east of this line in Marion and Taylor counties, and the southern point of Clinton district, Monongalia, where the coal has thinned below minable dimensions, since in these localities it appears to be more or less irregular.

The thickness and relative position of the Upper Freeport coal in the rock column are exhibited in the sections in Chap-

ter IV for VanVoorhis, Mt. Chateau, McClaren, Morgantown, Sabraton, Aaron Creek, Rock Forge, Little Falls, Clinton Furnace, Triune, and Anita in Monongalia county; for Powell in Marion; and for Thornton and Stonehouse in Taylor. Its character, composition, calorific value and fuel ratio will be discussed fully in Chapter XII, along with an estimate of the probable minable area and tonnage of the bed by magisterial districts.

### The Bolivar Fire Clay.

The Bolivar fire clay lies immediately below the last described coal and has been so named from a town in Westmoreland county, Pa., where it has long been the basis of an important fire brick industry. It is generally a hard, flinty clay, ranging in thickness from 5 to 20 feet, and often replacing the Upper Freeport limestone.

In Monongalia county this clay has been opened and tested along Deckers creek, according to I. C. White<sup>1</sup>, on the Pixler farm where the bed contains some very good hard flint clay as well as several feet of soft plastic clay.

In the southern portion of Clinton district a high grade flint clay with a thickness of 6 feet crops apparently at this horizon in the public road on the Mary Rogers farm, 0.2 mile northwest of the common corner to Monongalia, Marion and Taylor counties, at an elevation of 1905' A.T., aneroid, about 120 feet above an opening in the Lower Kittanning coal, where a sample for analysis was collected, the composition of which is reported by Messrs. Hite and Krak as follows:

|   | Per cent.    |
|---|--------------|
| Silica (Si O <sub>2</sub> ).....                      | 58.99        |
| Ferric Iron (Fe <sub>2</sub> O <sub>3</sub> ).....    | 3.01         |
| Alumina (Al <sub>2</sub> O <sub>3</sub> ).....        | 24.95        |
| Lime (Ca O).....                                      | 1.08         |
| Magnesia (Mg O).....                                  | 0.11         |
| Soda (Na <sub>2</sub> O).....                         | 0.13         |
| Potassa (K <sub>2</sub> O).....                       | 0.45         |
| Titanium (Ti O <sub>2</sub> ).....                    | 0.78         |
| Phosphoric Acid (P <sub>2</sub> O <sub>5</sub> )..... | 0.09         |
| Moisture (H <sub>2</sub> O).....                      | 1.92         |
| Loss on ignition.....                                 | 8.58         |
| <hr/> Total.....                                      | <hr/> 100.09 |

1. Vol. II. W. Va. Geological Survey, p. 462; 1903.



For the same reasons assigned below for this clay near Thornton, the results show a fine clay for any product requiring high refractory qualities. Judging from the relative percentages of alumina and ferric iron, the clay would burn to a buff color.

In **Marion** this clay attains a good development in the eastern point of Winfield district. A sample for analysis was collected at its crop in the public road, 0.5 mile northeast of "Moran Schoolhouse" at an elevation of 1705'A.T., aneroid, where it is quite flinty, and 6 to 8 feet in thickness. The composition of the sample is reported by Messrs. Hite and Krak as follows:

|   | Per cent.     |
|---|---------------|
| Silica (Si O <sub>2</sub> ).....                      | 68.75         |
| Ferric Iron (Fe <sub>2</sub> O <sub>3</sub> ).....    | 2.06          |
| Alumina (Al <sub>2</sub> O <sub>3</sub> ).....        | 19.60         |
| Lime (Ca O).....                                      | 0.70          |
| Magnesia (Mg O).....                                  | 0.03          |
| Soda (Na <sub>2</sub> O).....                         | 0.04          |
| Potassa (K <sub>2</sub> O).....                       | 0.41          |
| Titanium (Ti O <sub>2</sub> ).....                    | 0.64          |
| Phosphoric Acid (P <sub>2</sub> O <sub>5</sub> )..... | 0.15          |
| Moisture (H <sub>2</sub> O).....                      | 1.11          |
| Loss on ignition.....                                 | 7.34          |
| <b>Total</b> .....                                    | <b>100.83</b> |

Although slightly higher in silica and lower in alumina than the samples for Monongalia and Taylor, yet the relatively low percentage—4.03—of fluxing constituents classes it as a highly refractory clay, adapted to the manufacture of fire brick and other heat resisting products.

In **Taylor** this clay of a flint type attains a fine development along the northern border of Fetterman district, south-eastward to Irondale from the common corner to Monongalia, Marion and Taylor counties. In this region it is 5 to 10 feet in thickness as exposed at crop along the ridge roads, and of extra fine quality.

In the southeast portion of Fetterman district this clay attains fair development along Threeforks creek near Thornton as exhibited in the section for the latter place, page 154. Two-fifths mile southeastward Reger collected a sample for

analysis and measured the following section at its crop at the U. G. Jennings coal mine on the east side of the North-western turnpike:

|   | Ft. | In. ° |
|---|-----|-------|
| 1. Sandstone, massive, Mahoning.....        | 30  | 0     |
| 2. Slate, black.....                        | 3   | 0     |
| 3. Coal, Upper Freeport, with partings..... | 5   | 1%    |
| 4. Fire clay, plastic, light, Bolivar.....  | 10  | 0     |

The composition of the sample from No. 4 of section is reported by Messrs. Hite and Krak as follows:

|   | Per cent.    |
|---|--------------|
| Silica (Si O <sub>2</sub> ).....                      | 57.43        |
| Ferric Iron (Fe <sub>2</sub> O <sub>3</sub> ).....    | 3.06         |
| Alumina (Al <sub>2</sub> O <sub>3</sub> ).....        | 26.59        |
| Lime (Ca O).....                                      | 0.27         |
| Magnesia (MgO).....                                   | 0.16         |
| Soda (Na <sub>2</sub> O).....                         | 0.23         |
| Potassa (K <sub>2</sub> O).....                       | 1.98         |
| Titanium (Ti O <sub>2</sub> ).....                    | 0.53         |
| Phosphoric Acid (P <sub>2</sub> O <sub>5</sub> )..... | 0.26         |
| Moisture .....  | 1.18         |
| Loss on ignition.....                                 | 8.25         |
| <b>Total .....</b>                                    | <b>99.94</b> |

The results reveal a clay adapted to the manufacture of both building and fire brick. The comparatively low percentage of the fluxing elements to that for the silica, alumina and water indicates a clay with high refractory qualities, and one that would burn into a yellowish brown or buff colored product.

### The Upper Freeport Limestone.

The Upper Freeport limestone, ranging in thickness from 5 to 15 feet, and having a wide distribution in Pennsylvania, belongs 5 to 20 feet below the Upper Freeport coal in northern West Virginia where it is quite irregular. It is a fresh or brackish water deposit as no marine fossils have ever been observed therein. Its crop should follow closely the same area as that outlined for the crop of the Upper Freeport coal on Map II. Its thickness and relative position in the rock

column are exhibited in the sections for Morgan Run in Monongalia, and for Thornton and Stonehouse in Taylor county.

In **Monongalia county** this stratum was once quarried on Deckers creek near Dellslow where the uppermost layers are frequently changed into carbonate of iron and were used in the old furnace there. In this region it has the following chemical composition according to G. P. Grimsley<sup>2</sup>:

|                          | Per cent. |
|--------------------------|-----------|
| Lime carbonate.....      | 88.21     |
| Magnesium carbonate..... | 3.05      |
| Silica .....             | 3.80      |
| Alumina and iron.....    | 4.97      |

In **Marion** the crop of this limestone was observed along the southwest border of Winfield district, 0.4 mile south of Canton (Winfield) where samples were collected for analysis and the following section measured by Reger:

|  | Ft. | In. |
|--|-----|-----|
| 1. Sandstone, shaly, Mahoning.....             |     |     |
| 2. Coal, soft, slaty..2' 6" }                  |     |     |
| 3. Shale, gray.....0 1 } Upper Freeport coal.. | 4   | 10  |
| 4. Coal .....1 4 }                             |     |     |
| 5. Fire clay, gray.....                        | 7   | 0   |
| 6. Slate, dark coaly.....                      | 1   | 6   |
| 7. Shale, gray, silicious.....                 | 6   | 0   |
| 8. Iron ore.....1' 0" } Upper Freeport         |     |     |
| 9. Limestone .....2 0 } Limestone.....         | 3   | 0   |

The composition of the samples from Nos. 8 and 9 of the section is reported by Messrs. Hite and Krak as follows under Lab. Nos. 621H and 622H, respectively:

| No. 8.                           |       | No. 9.  |              |
|----------------------------------|-------|---|--------------|
| Per cent.                        |       | Per cent.   |              |
| Silica (Si O <sub>2</sub> )..... | 14.84 | Silica (Si O <sub>2</sub> ).....                      | 12.17        |
| Metallic Iron.....               | 38.99 | Ferric Iron (Fe <sub>2</sub> O <sub>3</sub> ).....    | 18.17        |
| Lime (Ca O).....                 | 4.81  | Alumina (Al <sub>2</sub> O <sub>3</sub> ) (none)..... | 0.00         |
| Sulphur .....                    | 1.31  | Calcium Carbonate (Ca CO <sub>3</sub> ).....          | 53.32        |
| Phosphorus .....                 | 0.36  | Magnesium Carbonate (Mg CO <sub>3</sub> )..           | 7.66         |
|                                  |       | Phosphoric Acid (P <sub>2</sub> O <sub>5</sub> )..... | 0.67         |
|                                  |       | Loss on ignition.....                                 | 7.36         |
|                                  |       | <b>Total.....</b>                                     | <b>99.35</b> |

In **Taylor** this limestone attains a fair development along the eastern border of Fetterman district. Just across the county line in Preston this ledge was once quarried quite extensively both for ore and fluxing material for use in the old iron furnaces near Irondale. Its composition and character there will be given in a report now under preparation by the Survey for Preston county.

### The Upper Freeport Sandstone.

In the interval between the Upper and Lower Freeport coals there frequently belongs a massive, arenaceous stratum, 15 to 40 feet in thickness, that has been termed the **Upper Freeport sandstone** in contradistinction to the Lower Freeport sandstone below. It crops over practically the same area as that outlined for the Upper Freeport coal bed on Map II. Its thickness, character and relative position in the rock column are exhibited in the sections for Cassville, VanVoorhis, Morgan Run, Sabraton, Aaron Creek and Rock Forge in Monongalia; for Powell in Marion; and for Grafton and Cecil in Taylor county. On the southwest border of Knottsville district, Taylor, this ledge has been quarried extensively for building purposes by Grafton parties along the Grafton & Belington Branch of the B. & O. R. R., 0.3 mile southeast of Stonehouse on the land of McDaniel Heirs, at an elevation of 1060' A.T., aneroid, where the following section was measured by Reger:

|  | Feet. |
|--|-------|
| 1. Sandstone, massive, Mahoning.....                     | 20    |
| 2. Fire clay and spring, Upper Freeport coal horizon.... | 1     |
| 3. Concealed .....                                       | 29    |
| 4. Sandstone, broken....10'                              |       |
| 5. Sandstone, hard, massive, quarry rock...20            |       |
| } Upper Freeport Sandstone..                             | 30    |
| 6. Coal, streak Lower Freeport.....                      | 0     |
| 7. Concealed to Valley river.....                        | 70    |

"No. 5 of section, the quarry rock, is hard, massive, gray, very coarse-grained with small quartz pebbles, weathering to brown. It seems very durable and makes prominent cliffs on both sides of Tygart Valley river. Bedding and joint planes are far apart and large blocks can be split without difficulty. Joint planes extend through the quarry at an angle of about 60° with the vertical. Product used for bridge work and retaining walls, and shipped to Fairmont and Grafton. The stone used in the bridge over Threeforks creek at the latter city came from this quarry."

No other quarries were observed on this ledge.

The **Middle Freeport coal**, belonging 25 to 35 feet below the Upper Freeport bed, was not observed at crop in the area, but the coal test borings used in connection with the Aaron Creek and Sabraton sections, pages 119 and 118, respectively, place its horizon in the body of the Upper Freeport sandstone in a manner similar to that occupied by the Kittanning coal in the Lower Freeport sandstone at the later coal's type locality.

### **The Lower Freeport Coal.**

The **Lower Freeport coal** of the First Geological Survey of Pa., belonging 45 to 75 feet below the top of the Allegheny series, is a multiple-bedded seam of wide but irregular distribution in West Virginia. Its crop roughly follows the region outlined for the crop of the Upper Freeport coal on Map II. Its thickness and relative position in the rock column are exhibited in the sections for Morgan Run, Mt. Chateau, Beaver Hole, Morgantown, Sabraton, Aaron Run, Rock Forge, Clinton Furnace and Anita in Monongalia; for Downs and Powell in Marion; and for Webster, Grafton, Thornton SW, Stonehouse, Bennett No. 2 Bore Hole and Cecil in Taylor county. Judging from its exposures at crop and from these several sections the bed is too thin and irregular to be classed as a minable vein.

### **The Lower Freeport Limestone.**

The **Lower Freeport limestone** belongs 5 to 10 feet below the last coal described, and, like the Upper Freeport limestone above, it contains only univalve fossils, indicating its fresh water origin. It very much resembles the latter limestone both in color and physical appearance. Its crop follows closely the area outlined for the Lower Freeport coal. Its thickness and relative position in the rock column are indicated in the sections for Morgan Run, Clinton Furnace and and Dellslow in Monongalia.

A sample for analysis was collected at its crop at Clinton

Furnace (See Clinton Furnace section page 123), the composition of which is reported by Messrs. Hite and Krak as follows under Lab. No. 672H:

|   | Per Cent      |
|---|---------------|
| Silica (Si. O <sub>2</sub> ).....                     | 6.57          |
| Ferric Iron (Fe <sub>2</sub> O <sub>3</sub> ).....    | 5.53          |
| Alumina (Al <sub>2</sub> O <sub>3</sub> ).....        | 3.80          |
| Calcium Carbonate (Ca CO <sub>3</sub> ).....          | 78.92-        |
| Magnesium Carbonate (Mg CO <sub>3</sub> ).....        | 1.87          |
| Phosphoric Acid (P <sub>2</sub> O <sub>5</sub> )..... | 0.22          |
| Loss on ignition .....                                | 3.29          |
| <b>Total .....</b>                                    | <b>100.20</b> |

The results show it too high in sandy and clayey matter to burn into a good commercial lime. The ledge is too thin and irregular to have much value for natural cement utilization, but it should furnish a limited amount of fair road material.

On the northern edge of Knottsville district, Taylor county, Reger collected a sample of what appears to be this limestone and measured the following section on the south bank of Threeforks creek, 0.2 mile southwest of Thornton:

|  | Feet. |
|--|-------|
| 1. Sandstone, shaly .....                              | 15    |
| 2. Shale, limy .....                                   | 2     |
| 3. Sandstone, massive.....                             | 4     |
| 4. Shale, limy .....                                   | 1     |
| 5. Sandstone, massive, Upper Freeport.....             | 15    |
| 6. Sandstone, limy .....                               | 10    |
| 7. Limestone, yellow.....2'                            |       |
| 8. Limestone, brecciated } Lower Freeport.....17       |       |
| to railroad grade...15 }                               |       |
| (Elevation of base section, 1055' A. T. spirit level). |       |

The composition of the sample from No. 7 only of section is reported by Messrs. Hite and Krak as follows under Lab. No. 570H:

|   | Per cent.    |
|---|--------------|
| Silica (Si O <sub>2</sub> ).....                      | 22.83        |
| Ferric Iron (Fe <sub>2</sub> O <sub>3</sub> ).....    | 9.73         |
| Alumina (Al <sub>2</sub> O <sub>3</sub> ).....        | 7.17         |
| Calcium Carbonate (Ca CO <sub>2</sub> ).....          | 47.30        |
| Magnesium Carbonate (Mg CO <sub>3</sub> ).....        | 6.43         |
| Phosphoric Acid (P <sub>2</sub> O <sub>5</sub> )..... | 0.26         |
| Loss on ignition.....                                 | 5.32         |
| <b>Total .....</b>                                    | <b>99.04</b> |

The results show this sample much higher in impurities than that for Clinton Furnace above.

### **The Lower Freeport Sandstone.**

The **Lower Freeport Sandstone**, belonging 5 to 15 feet below the Lower Freeport coal and ranging in thickness from 30 to 100 feet, is the most persistent sandstone of the Allegheny series, and was designated by Lesley from its crop in bold cliffs near Freeport, Pennsylvania. It is usually grayish white, very hard, micaceous, often pebbly, and massive, splitting unevenly; hence, it is not well adapted to quarrying for building stone. At its type locality in Pennsylvania it frequently carries a coal bed near its middle; viz., the Upper Kittanning. In northern West Virginia this sandstone is generally divided into two divisions—upper and lower—by the same coal, the Johnstown (cement) limestone and the Hardman fire clay. The thickness, character and relative positions of these divisions in the rock column are exhibited in the sections for St. Cloud, Cassville, Van Voorhis, Morgan Run, Beaver Hole, Morgantown, Clinton Furnace, and Anita in Monongalia; for Glover Gap, Montana Mines and Powell in Marion; and for Webster, Stonehouse and Cecil in Taylor county. Some gas is often found in this formation; hence the term "gas sand" by the oil and gas well drillers: This sandstone crops in bold cliffs along the steep western slope of the Chestnut Ridge anticline across Monongalia and Marion counties, and in the northern and southeast portions of Taylor, where it is often mistaken for the Homewood at the top of the Pottsville series. It is the Lower Freeport that forms the shoals in Tygart Valley river at Stonehouse in Taylor, and the "rock city" along the west bank of the same stream, 0.5 mile southeastward.

No quarries were observed on this ledge.

### **The Upper Kittanning Coal.**

The **Upper Kittanning Coal** is of some importance in this area. Its stratigraphic horizon is between the upper and lower divisions of the Lower Freeport sandstone, from 90 to

120 feet below the Upper Freeport coal and from 40 to 60 feet above the Lower Kittanning. It is irregular in its distribution, often being absent entirely from the measures, and when present seldom exceeds 4 feet in thickness at its outcrop, although several oil well records in Cass district, Monongalia county, and in western Taylor county give it a greater thickness, in which it is probable that the overlying slate is included. It is double-bedded, invariably carrying a thin slate parting about ten inches from the bottom, and often has a black, lustrous, cannel slate immediately over the top. The following is a type section:

|  | Ft. | In. |
|--|-----|-----|
| 1. Sandstone, massive, Lower Freeport..... | ..  | ..  |
| 2. Slate, black, cannel.....               | 0   | 6   |
| 3. Coal, good, soft...2' 6" }              |     |     |
| 4. Slate, gray ..1" to 0 2 }               | 3   | 6   |
| 5. Coal, good.....0 10 }                   |     |     |

In Monongalia county its crop is confined to Union, Morgan and Clinton districts; in Marion, to Winfield and Union districts; and in Taylor to Booths Creek, Feterman and Knottsville districts. Its short interval from the Lower Kittanning coal, the crop of which appears on Map II, will readily determine where it occurs above drainage.

In Chapter IV it is described in the sections for Van Voorhis, Morgan's Run, Morgantown, Aaron Creek, Rock Forge, Clinton Furnace, Powell, Webster, Irondale, Southwest of Thornton, Bennett No. 2 Coal Test and Cecil.

In **Monongalia county** a considerable area of this coal is recorded by oil well records on both sides of the Monongahela river in Cass, Union and Morgan districts, a table of which will be found in chapter XII. At its crop in Union and Morgan districts the coal is not of commercial dimensions, but a considerable thickness was observed at the head of Booths Creek and near Halleck in Clinton district. A section made by Reger at the Emory Jones mine, 1.5 miles south of Clinton Furnace, shows the following structure:



## Emory Jones Mine, Upper Kittanning Coal. No. 82 on Map II.

|  | Ft.     | In. |
|--|---------|-----|
| 1. Shale, gray, with streaks of sandstone..... | ..      | ..  |
| 2. Slate, black, cannel .....                  | 0       | 8   |
| 3. Coal, good.....1' 8"                        |         |     |
| 4. Slate .....0 1                              |         |     |
| 5. Coal, good.....0 9                          | } ..... | 2 6 |
| (Elevation, 1500' A. T. Aneroid.)              |         |     |

A sample was collected here for analysis from Nos. 3 and 5, the results of which as reported by Messrs. Hite and Krak are given in the table of coal analyses under No. 82.

The same coal is found with the following structure on the land of Mrs. Nelson Jacobs, one-third mile west of the Jones mine:

|  | Ft.     | In.               |
|--|---------|-------------------|
| Slate, black, sandy .....                  | 5       | 0                 |
| Cannel slate .....                         | 0       | 5                 |
| Coal .....2' 0 $\frac{1}{4}$ "             |         |                   |
| Slate, gray.....0 2                        |         |                   |
| Coal .....1 0                              | } ..... | 3 1 $\frac{3}{4}$ |
| Slate and concealed .....                  |         | ..                |
| (Elevation of coal, 1400' A. T., Aneroid.) |         |                   |

The Upper Kittanning coal is mined for farm use, on a run tributary to Whiteday creek, 1.2 miles northwest of Halleck, where Reger obtained the following section:

|                                   | Ft.     | In. |
|-----------------------------------|---------|-----|
| Shale, gray .....                 | 3       | 0   |
| Slate, black .....                | 0       | 6   |
| Coal .....2' 0"                   |         |     |
| Slate, gray.....0 2               |         |     |
| Coal .....0 10                    | } ..... | 3 0 |
| (Elevation, 1510' A.T., Aneroid.) |         |     |

The coal is mined along the public road, 1.2 miles north-east of Halleck, where it shows the following section:

|  | Ft.     | In. |
|--|---------|-----|
| Coal .....2' 9"                            |         |     |
| Slate, gray .....0 2                       |         |     |
| Coal .....0 9                              | } ..... | 3 8 |
| Fire clay .....                            | 1       | 0   |
| (Elevation of coal, 1920' A. T., Aneroid.) |         |     |

The upper Kittanning coal is mined on the land of Nancy

Martin, on Laurel run, 1.5 miles S. 70° W. of Gladesville, where it has the following section:

|                     | Ft.     | In.  |
|---------------------|---------|------|
| Concealed .....     |         | ..   |
| Coal blossom .....  | 0       | 0    |
| Shale .....         | 4       | 0    |
| Cannel slate .....  | 0       | 4    |
| Coal .....1' 7½"    | } ..... | 2 5½ |
| Slate, gray.....0 1 |         |      |
| Coal .....0 9       |         |      |
| Shale .....         |         | ..   |

(Elevation of coal, 1745' A. T., Aneroid).

In Marion county the oil well logs do not record Upper Kittanning coal. In Winfield district the coal was once opened on Piney run, 1.2 miles southeast of Canton, where Reger obtained the following section:

|  | Ft.     | In. |
|--|---------|-----|
| Shale, gray, silicious, laminated..... | 3       | 0   |
| Coal, good .....0' 2"                  | } ..... | 8 1 |
| Coal, slaty .....0 3                   |         |     |
| Shale, gray .....3 0                   |         |     |
| Sandstone 1" to.....0 8                |         |     |
| Slate, black .....2 0                  |         |     |
| Coal, partly concealed.2 10            |         |     |

(Elevation, 1055' A. T., Aneroid.)

Three-fourths mile northwest of Neel, the Upper Kittanning coal is mined and the following section was obtained:

|                           | Ft.     | In. |
|---------------------------|---------|-----|
| Slate, black, roof.....   |         | ..  |
| Coal, good .....1' 0"     | } ..... | 4 3 |
| Coal, bony and slaty..0 4 |         |     |
| Coal, good .....1 11      |         |     |
| Slate, black .....0 1     |         |     |
| Coal, good .....0 11      |         |     |
| Slate, pavement .....     |         | ..  |

(Elevation, 1380' A. T., Aneroid.)

A prospect opening in the Upper Kittanning on the head of Dunham Lick run, 1.2 miles west of Neel, shows the following section:

|                        | Ft.     | In. |
|------------------------|---------|-----|
| Concealed .....        |         | ..  |
| Coal, good .....2' 6 " | } ..... | 3 ¾ |
| Slate, black .....0 0¼ |         |     |
| Coal, good.....0 9     |         |     |

(Elevation, 1375' A. T., Aneroid.)

Another opening, evidently the Upper Kittanning coal, was examined by Reger opposite the mouth of Mudlick run, where the following section was obtained:

|                                       | Ft. | In. |
|---------------------------------------|-----|-----|
| Shale, gray .....                     | 5   | 0   |
| Coal, soft .....0' 9" } .....         | 2   | 6   |
| Slate, black, cannelly..0 5           |     |     |
| Coal .....1 4                         |     |     |
| Concealed by water, .....             | ..  | ..  |
| (Elevation, 1288' A. T., Hand Level). |     |     |

The Upper Kittanning coal was opened once on the land of Jacob Rogers in Union district on Prickett creek, one mile southward from Dunham Lick run, but the mine had fallen shut and its thickness could not be obtained.

A good exposure of the Upper Kittanning coal appears on Whiteday creek near the Moran Schoolhouse, where it has the following section on the land of R. Q. Musgrove:

|                                     | Ft. | In. |
|-------------------------------------|-----|-----|
| Sandstone, massive .....            | ..  | ..  |
| Concealed .....                     | 5   | 0   |
| Coal bony, left up....0' 7" } ..... | 5   | 2   |
| Coal, soft .....2 0                 |     |     |
| Slate, black.....0 1                |     |     |
| Coal, soft .....1 3                 |     |     |
| Slate, gray .....0 6                |     |     |
| Coal .....0 9                       |     |     |
| Fire clay .....                     | ..  | ..  |
| (Elevation, 1610' A. T., Aneroid.)  |     |     |

The Upper Kittanning coal is opened on the head of Grassy run about one-fifth mile east of the crossroads at Gath, where Reger obtained the following section:

|  | Ft. | In. |
|--|-----|-----|
| Sandstone, gray pebbly.....                | 25  | 0   |
| Coal .....0' 8" } .....                    | 2   | 2   |
| Slate .....1 0                             |     |     |
| Coal .....0 6                              |     |     |
| Shale, gray.....                           | 4   | 0   |
| (Elevation of coal, 1230' A. T., Aneroid). |     |     |

In Taylor county, the Upper Kittanning coal is mined along the Tygart Valley river, where it is locally known as the "Four-Foot" seam. Three-fourths mile southeast of Valley Falls the following section was obtained south of the river on the land of C. N. Mason:

**C. N. Mason Mine, Upper Kittanning Coal. No. 85 on Map II.**

|                           | Ft. | In.       |
|---------------------------|-----|-----------|
| 1. Slate .....            | ..  | ..        |
| 2. Coal, soft .....3' 2 " | }   | 3      8½ |
| 3. Slate, gray .....0 1   |     |           |
| 4. Coal, soft .....0 5½   |     |           |
| 5. Fire clay .....        |     |           |

(Elevation, 1095' A. T., Aneroid).

The composition, calorific value and fuel ratio of the sample from Nos. 2 and 4 of section are given in the table of coal analyses under No. 85.

The coal was formerly mined on Tucker run, about 1 mile south of Valley Falls, where it was reported by Mr. C. B. Kinsey to be 4 feet thick. A partial section was obtained as follows:

|                                  | Ft. | In. |
|----------------------------------|-----|-----|
| Sandstone, massive, visible..... | 10  | 0   |
| Slate, sandy .....               | 1   | 0   |
| Coal, blocky .....               | 2   | 0   |
| Concealed by water .....         | ..  | ..  |

(Elevation, 1070' A. T., Aneroid).

The coal is mined on a commercial scale by the Winona Coal & Coke Company at Coffman Station in Fetterman district. This mine will be described later in Chapter XII.

It was formerly mined near Coffman Station by the Bessemer Coke Company, where the following section was obtained:

|                                    | Ft. | In.       |
|------------------------------------|-----|-----------|
| Sandstone, massive.....            | 10  | 0         |
| Shale, with flaggy sandstone ..... | 5   | 0         |
| Coal .....0' 11 "                  | }   | 3      7½ |
| Bone .....0 0½                     |     |           |
| Coal .....1 9                      |     |           |
| Slate .....0 1                     |     |           |
| Coal .....0 10                     |     |           |

(Elevation, 1013' A. T., Hand Level.)

The Upper Kittanning coal appears in many of the records of oil wells drilled near the common corner to Booths Creek, Flemington and Courthouse districts. Its occurrence in this region will be described in Chapter XII.

In the central part of Taylor county in the Grafton re-

gion the horizon of the Upper Kittanning coal is entirely under drainage. Inasmuch as no drilling records could be obtained there, its presence is an open question. The A. J. Bartlett core test, No. 719 on Map II, at Webster shows a thickness of 4.8 feet, and the E. H. Bennett core test No. 2—No. 724 on Map II—at Stonehouse records 2 feet of coal.

The coal appears above drainage along the Tygart Valley river near the Barbour county line. A section measured at an exposure on the Arthur Male farm 1 mile southwest of Cecil, shows the following:

|  | Ft. | In. |
|--|-----|-----|
| Sandstone, massive, Lower Freeport ..... | 40  | 0   |
| Coal, hard, blocky.....0' 10" } .....    | 1   | 10  |
| Coal, soft.....1 0 } .....               |     |     |
| Fire clay, medium .....                  | 2   | 9   |
| Cannel slate .....0' 6" } .....          |     |     |
| Coal .....2 9 } .....                    | 4   | 5   |
| Slate .....0 1 } .....                   |     |     |
| Coal .....1 1 } .....                    |     |     |
| Fire clay .....                          | ..  | ..  |

(Elevation, 1050' A. T., Aneroid.)

Here the lower portion shows the type section of the Upper Kittanning coal, while the upper represents a rider that sometimes appears and that has caused the coal in the Valley Falls region to be called the "Dirty Nine-foot."

The Upper Kittanning coal is exposed in the river hill along the B. & O. Railroad, one-third mile west of Cecil, but only a partial section was visible. On the south side of the river a prospect opening in the hill west of the Overholt Coal & Coke Company plant shows the following:

|  | Ft. | In. |
|--|-----|-----|
| Sandstone, massive, visible, Lower Freeport..... | 12  | 0   |
| Coal, medium hard ...0' 7" } .....               |     |     |
| Coal, soft .....0 8 } .....                      | 5   | 2   |
| Slate .....1 7 } .....                           |     |     |
| Coal .....2 4 } .....                            |     |     |
| Concealed by water .....                         | ..  | ..  |

(Elevation, 1080' A. T., Hand Level.)

The Upper Kittanning coal appears in the northeastern part of Taylor county near the common corner to Monongalia, Marion and Taylor. A coal mine on the head of Maple run, in the edge of Marion county, examined by Reger, shows the following section:

|                           | Ft. | In. |
|---------------------------|-----|-----|
| Slate, black.....1' 0" }  | 1   | 8   |
| Coal, slaty.....0 8 }     |     |     |
| Shale, gray .....         | 2   | 6   |
| Slate, black .....0' 5" } | 2   | 10  |
| Coal, good .....1 9 }     |     |     |
| Slate, gray.....0 2 }     |     |     |
| Coal .....0 6 }           |     |     |

(Elevation, 1875' A. T., Aneroid.)

Here the coal carries the same rider that is found along the Tygart Valley river.

The Upper Kittanning coal is mined on Whiteday creek, 1.3 miles northeast of McConkey Schoolhouse, where it has the following section:

**W. A. Carrothers Mine, Upper Kittanning Coal. No. 83 on Map II.**

|                             | Ft. | In. |
|-----------------------------|-----|-----|
| 1. Sandstone, massive ..... | 5   | 0   |
| 2. Shale, sandy, gray ..... | 1   | 0   |
| 3. Slate, black .....       | 8   | 1   |
| 4. Coal, hard .....1' 0" }  | 8   | 1   |
| 5. Slate, black .....1 0 }  |     |     |
| 6. Sandstone, dark, hard..  |     |     |
| .....0 2                    |     |     |
| 7. Shale, gray, soft ..1 0  |     |     |
| 8. Coal, bony .....0 10     |     |     |
| 9. Coal .....1 7            |     |     |
| 10. Slate, gray 0½" to.0 1  |     |     |
| 11. Coal .....1 3           |     |     |
| 12. Shale, gray .....1 8    |     |     |
| 13. Coal .....0 6           |     |     |

(Elevation, 1528' A. T., Hand Level.)

Here Reger collected a sample for analysis from Nos. 9, 11 and 13 of section, the results of which, as reported by Messrs. Hite and Krak, are given in the table of coal analyses under No. 83 (Lab. No. 603H).

The Upper Kittanning coal is mined on the head of Whiteday creek, 2 miles northeast of McConkey schoolhouse where Reger measured the following section:

|                        | Ft. | In. |
|------------------------|-----|-----|
| Shale, gray .....      | 0   | 6   |
| Slate, black .....     | 4   | 3   |
| Coal .....1' 9" }      | 4   | 3   |
| Slate, gray .....0 1 } |     |     |
| Coal .....1 4 }        |     |     |
| Slate, gray .....0 7 } |     |     |
| Coal .....0 6 }        |     |     |

(Elevation, 1610' A. T., Aneroid.)

The coal is mined along the county road 1.6 miles N. 75° W. of Irondale, where Reger reports the following section:

|                      | Ft. | In.  |
|----------------------|-----|------|
| Slate, visible ..... | 1   | 0    |
| Coal .....1' 3"      | }   | 3 11 |
| Slate, gray .....0 2 |     |      |
| Coal .....1 6        |     |      |
| Slate .....0 5       |     |      |
| Coal .....0 7        |     |      |

(Elevation, 1415' A. T., Hand Level.)

It will be seen from the foregoing sections that the Upper Kittanning coal has a wide distribution and is an important mineral resource of the three counties.

### The Upper Kittanning Fire Clay.

At the Monongalia-Preston county line, one mile north-west of Cascade, an excellent flint fire clay makes its appearance immediately under the Upper Kittanning coal. Here Reger made the following section at the prospect mine of Knowlton and Ford:

|   | Ft. | In. |
|---|-----|-----|
| 1. Slate, black, hard, Upper Kittanning coal..... | 3   | 0   |
| 2. Fire clay, plastic .....                       | 2   | 0   |
| 3. Fire clay flint, Upper Kittanning.....         | 9   | 0   |
| 4. Sandstone, hard 10" to .....                   | 1   | 0   |
| 5. Fire clay, flint, Hardman .....                | 2   | 0   |
| 6. Sandstone, hard .....                          | 0   | 4   |
| 7. Fire clay, dark gray, plastic .....            | 14  | 0   |

(Elevation of coal, 1980' A. T., Aneroid.)

The large body of flint fire clay that appears in No. 3 of section has not been previously noted in the detailed county reports and will therefore be called the **Upper Kittanning Fire Clay**.

Samples collected from Nos. 3, 5 and 7 showed the following analyses according to Messrs. Hite and Krak:

|   | No. 3  | No. 5 | No. 7 |
|---|--------|-------|-------|
| Silica (Si O <sub>2</sub> ).....                    | 57.78  | 41.00 | 56.56 |
| Ferric Iron (Fe <sub>2</sub> O <sub>3</sub> ).....  | 1.24   | 1.88  | 2.35  |
| Alumina (Al <sub>2</sub> O <sub>3</sub> ).....      | 28.60  | 38.28 | 27.21 |
| Lime (Ca O).....                                    | 0.37   | 1.88  | 0.37  |
| Magnesia (Mg O).....                                | 0.17   | 0.35  | 0.26  |
| Sodium (Na <sub>2</sub> O).....                     | 0.34   | 0.31  | 0.49  |
| Potassium (K <sub>2</sub> O).....                   | 0.31   | 0.14  | 1.76  |
| Titanium (Ti O <sub>2</sub> ).....                  | 0.29   | 0.28  | 0.30  |
| Phosphoric Acid (P <sub>2</sub> O <sub>5</sub> )... | 0.10   | 0.50  | 0.07  |
| Moisture .....                                      | 0.86   | 1.85  | 0.93  |
| Loss on ignition.....                               | 10.85  | 13.08 | 9.45  |
| Total .....   | 100.91 | 99.55 | 99.75 |

It is possible that the hard lens of sandstone, No. 4 of section, is a replacement of the Johnstown Cement Limestone, although a chemical test gave no carbonate reaction. If this is true, the fire clay noted under No. 5 of section would represent the Hardman fire clay, which is now mined at Hardman in Preston county and which will be described fully in the detailed report of that county, soon to be published.

### The Johnstown Cement Limestone.

The next horizon of the Allegheny series is the **Johnstown Cement Limestone** which Mr. Franklin Platt named from its occurrence in Cambria county, Pennsylvania. It is usually found, if present at all, a few feet under the Upper Kittanning coal.

In **Monongalia county** this limestone makes its appearance on a branch of Booths creek, one mile northeast of Clinton Furnace, where Reger obtained the following section:

|   | Feet. |
|---|-------|
| Coal, thickness concealed, Upper Freeport ..... | 0     |
| Shales, ferriferous .....                       | 15    |
| Concealed .....                                 | 95    |
| Coal blossom, Upper Kittanning.....             | 0     |
| Concealed .....                                 | 4     |
| Limestone, hard, Johnstown Cement .....         | 6     |

The limestone has been quarried for local agricultural use. A sample collected for analysis—Laboratory No. 654H—gave the following results, according to Messrs. Hite and Krak:

### Clark Haigh Quarry, Johnstown Cement Limestone.

|   | Feet.         |
|---|---------------|
| Silicia (Si O <sub>2</sub> ).....                     | 2.88          |
| Ferric Iron (Fe <sub>2</sub> O <sub>3</sub> ).....    | 4.13          |
| Alumina (Al <sub>2</sub> O <sub>3</sub> ).....        | 0.74          |
| Calcium Carbonate (Ca CO <sub>3</sub> ).....          | 42.84         |
| Magnesium Carbonate (Mg CO <sub>3</sub> ).....        | 11.03         |
| Phosphoric Acid (P <sub>2</sub> O <sub>5</sub> )..... | 0.10          |
| Loss on ignition and undetermined .....               | 38.28         |
| <b>Total .....</b>                                    | <b>100.00</b> |

The Johnstown cement limestone is present in good



thickness at the road fork on Whiteday creek, one mile north of Anita, where it shows the following section:

|   | Ft. | In. |
|---|-----|-----|
| Sandstone, massive .....                      | 10  | 0   |
| Shale, gray .....                             | 4   | 0   |
| Coal, soft, Upper Kittanning.....             | 0   | 6   |
| Fire clay .....                               | 1   | 6   |
| Limestone, gray, hard, Johnstown cement ..... | 4   | 0   |
| (Elevation of coal, 1015' A. T., Aneroid.)    |     |     |

A sample collected for analysis here—Laboratory No. 594H—yielded the following results, according to Messrs. Hite and Krak:

|  | Per cent. |
|--|-----------|
| Silicia (Si O <sub>2</sub> ) .....                     | 3.42      |
| Ferric Iron (Fe <sub>2</sub> O <sub>3</sub> ).....     | 1.54      |
| Alumina (Al <sub>2</sub> O <sub>3</sub> ) .....        | 0.75      |
| Calcium Carbonate (Ca CO <sub>3</sub> ) .....          | 90.89     |
| Magnesium Carbonate (Mg CO <sub>3</sub> ).....         | 2.24      |
| Phosphoric Acid (P <sub>2</sub> O <sub>5</sub> ) ..... | 0.63      |
| Loss on ignition .....                                 | 0.46      |
| Total .....  | 99.93     |

In **Marion county** the Johnstown Cement Limestone was noted on Piney run of Prickett creek, one mile southeast of Canton, where Reger made the following section:

|  | Ft. | In. |
|--|-----|-----|
| Sandstone .....                            | 7   | 0   |
| Shale, gray silicious .....                | 0   | 4   |
| Coal .....                                 | 3   | 0   |
| Shale, gray .....                          | 0   | 4   |
| Sandstone .....                            | 2   | 0   |
| Shale, gray .....                          | 0   | 6   |
| Slate, black .....                         | 1   | 8   |
| Coal .....                                 | 0   | 1   |
| Slate, gray .....                          | 0   | 6   |
| Coal .....                                 | .8  | 0   |
| Shale, gray, silicious.....                | 0   | 6   |
| Coal .....                                 | 1   | 0   |
| Shale, gray .....                          | 1   | 0   |
| Limestone, Johnstown cement .....          | 5   | 0   |
| Shaly, gray, limy, to run.....             | 5   | 0   |
| (Elevation of coal, 1060' A. T., Aneroid.) |     |     |

Stratigraphic studies in this vicinity show that the coal noted above is the Upper Kittanning, although it does not resemble the type section. The Johnstown limestone here is too thin to be valuable.

This limestone is quarried for local agricultural use on Grassy run of Prickett creek, one-half mile east of Gath, where Reger made the following section:

|   | Ft. | In. |
|---|-----|-----|
| 1. Sandstone, massive, making cliff .....         | 20  | 0   |
| 2. Concealed .....                                | 60  | 0   |
| 3. Sandstone, flaggy .....                        | 9   | 0   |
| 4. Coal, good, no partings, Upper Kittanning..... | 1   | 4   |
| 5. Concealed .....                                | 10  | 0   |
| 6. Sandstone, concealed and sandstone .....       | 10  | 0   |
| 7. Limestone, good, Johnstown Cement .....        | 2   | 0   |
| 8. Concealed .....                                | 18  | 0   |
| 9. Coal, Lower Kittanning .....                   | ..  | ..  |

(Elevation of limestone, 1178' A. T., Aneroid).

A sample collected here for analysis—Laboratory No. 623H—from No. 7 of section gave the following results according to Messrs. Hite and Krak:

|  | Per cent.    |
|--|--------------|
| Silicia (Si O <sub>2</sub> ) .....                     | 9.19         |
| Ferric Iron (Fe <sub>2</sub> O <sub>3</sub> ).....     | 2.20         |
| Alumina (Al <sub>2</sub> O <sub>3</sub> ).....         | 1.73         |
| Calcium Carbonate (Ca CO <sub>3</sub> ).....           | 76.51        |
| Magnesium Carbonate (Mg CO <sub>3</sub> ).....         | 5.92         |
| Phosphoric Acid (P <sub>2</sub> O <sub>5</sub> ) ..... | 0.36         |
| Loss on ignition .....                                 | 3.97         |
| <b>Total .....</b>                                     | <b>99.88</b> |

The limestone is exposed in the measures in the eastern part of Taylor county. One-third mile west of Cecil it is 2.5 feet thick, gray on fresh fracture, but weathers to yellow. Its relation to the other strata may be seen by reference to the Cecil section published on a previous page.

### The Hardman Fire Clay.

Immediately under the Johnstown Cement limestone an excellent flint fire clay makes its appearance and is mined commercially one mile north of Hardman, Preston county, near the Taylor county line. It will be described in detail in the report on Preston County soon to be published.

The Hardman fire clay is also visible at Irontown, in the hill north of the B. & O. Railroad, where, according to Reger, it is 9 feet thick, hard and flinty, coming 1152 feet above tide.

It has been prospected into the hill a sufficient distance to show that it is a valuable deposit.

### **The Middle Kittanning Coal.**

The Middle Kittanning coal, which sometimes appears in the Allegheny series between the Upper and Lower Kittanning, was noted with certainty at only one place in the territory of this report, viz., in the Bennett No. 2 bore hole, No. 724 on Map II, at Stonehouse, Taylor county, where it is 1 foot thick and 29 feet under the Upper Kittanning coal. The bore hole record is published on a previous page.

### **The Lower Kittanning Coal.**

The Lower Kittanning coal, which was named by Prof. Lesley from its occurrence in Armstrong county, Pennsylvania, is of great economic importance in the territory of this report. The section of the coal varies greatly throughout the area and for this reason a type formation cannot be given. It will usually be found, however, that the Lower Kittanning coal carries, near the middle of the seam, a heavy streak of bony coal or shale, the thickness of which runs from a few inches to one foot. This heavy impurity serves in a large measure to distinguish the coal from the Upper Kittanning bed above and the Clarion coal below, neither of which has such a marked feature.

The crop of the Lower Kittanning coal is shown in detail on Map II by an appropriate symbol. In Monongalia county the crop is roughly parallel to the Monongahela river and the Chestnut Ridge anticline, between which it appears.

In Marion county the crop of the Lower Kittanning coal is limited to the eastern portions of Winfield and Union districts.

In Taylor county there is a small region of crop in Booths Creek district along the Tygart Valley river. In the eastern part of the county it crops on the waters of Whiteday, Threefork and Sandy creeks and on the Tygart Valley river.

The stratigraphic relations and the thickness of the Lower

Kittanning coal may be found in great detail by reference to the geologic sections for Clinton Furnace, Triune, Anita, Montana Mines, Powell, Webster, Irondale and Cecil.

By reference to the "List of Wells Recording Lower Kittanning Coal", published on a subsequent page, it will be seen that, with the exception of a small deposit in Cass district, Monongalia county, no Lower Kittanning coal has been found west of the Monongahela river. East of the river in Monongalia and Marion counties there has not been sufficient drilling to outline with certainty the extent of the coal where it lies under drainage. In Taylor county several wells drilled at Pruntytown, Meadland, Webster and Stonehouse indicate that a large amount of the coal lies buried beneath the overlying strata of that county.

In **Monongalia county**, no Lower Kittanning coal of sufficient importance to deserve mention was found along the crop north of the Morgan-Clinton district line. At Clinton Furnace on Booths creek, the coal is 3 feet thick as recorded in the section. One-third mile south of Clinton Furnace, Reger examined an exposure of this bed in the hill east of Booths creek as follows:

|                          | Ft. | In. |
|--------------------------|-----|-----|
| Sandstone, massive ..... | ..  | ..  |
| Coal, good .....         | 3   | 0   |
| Shale, gray .....        | 0   | 5   |
| Concealed .....          | ..  | ..  |

(Elevation of coal, 1100' A. T., Aneroid.)

At the residence of Granville Brown, 1.3 miles north of Halleck, this coal has been mined and has the following section:

|                               | Ft. | In. |
|-------------------------------|-----|-----|
| Shale, gray .....             | 2   | 0   |
| Slate, gray and black .....   | 1   | 0   |
| Coal, bony .....1' 6" } ..... | 2   | 5   |
| Slate, black .....0 3 } ..... |     |     |
| Coal, soft .....0 8 } .....   |     |     |
| Slate .....                   | ..  | ..  |

(Elevation, 1790' A. T., Aneroid.)

The Lower Kittanning coal is mined extensively for domestic use on the land of Joseph Reppert, where Reger reports the following section:

## Joseph Reppert Mine, Lower Kittanning Coal.

## No. 87 on Map II.

|                       |       | Ft. | In. |
|-----------------------|-------|-----|-----|
| 1. Shale, dark .....  |       | 3   | 0   |
| 2. Coal .....         | 0' 2" |     |     |
| 3. Slate, black ..... | 0 3   |     |     |
| 4. Shale, gray.....   | 2 6   | 6   | 1   |
| 5. Coal .....         | 2 0   |     |     |
| 6. Slate .....        | 0 2   |     |     |
| 7. Coal .....         | 1 0   |     |     |

(Elevation, 1790' A. T., Aneroid.)

A sample collected for analysis from Nos. 5 and 7 is reported by Messrs. Hite and Krak in the table of coal analyses under No. 87 (Lab. No. 626-H).

The coal is mined one-fourth mile east of Halleck, where it has the following section:

## Lower Kittanning Coal. No. 88 on Map II.

|                                |       | Ft. | In. |
|--------------------------------|-------|-----|-----|
| 1. Concealed .....             |       |     |     |
| 2. Sandstone, dark, hard ..... |       | 0   | 2   |
| 3. Slate, black .....          |       | 0   | 5   |
| 4. Cannel slate.....           | 0' 3" |     |     |
| 5. Coal, soft.....             | 2 0   | 3   | 3   |
| 6. Slate, gray.....            | 0 1   |     |     |
| 7. Coal, soft .....            | 0 11  |     |     |
| 8. Slate .....                 |       |     |     |

(Elevation, 1825' A. T., Aneroid.)

A sample was collected for analysis from Nos. 5 and 7 and as reported by Messrs. Hite and Krak is given in the table of coal analyses under No. 88 (Lab. No. 579-H). This sample evidently contained a lens of sulphur as the analysis shows a much larger amount of this impurity than the Reppert mine, a short distance away.

This bed is mined 1.2 miles south of Halleck on the land of Wm. Phillips, where Reger secured the following section:

|                    |       | Ft. | In. |
|--------------------|-------|-----|-----|
| Coal .....         | 0' 5" |     |     |
| Shale, gray .....  | 2 3   |     |     |
| Slate, black ..... | 0 4   |     |     |
| Coal .....         | 1 11  |     |     |
| Slate, gray.....   | 0 2   | 6   | 9   |
| Coal .....         | 1 2   |     |     |
| Slate, gray .....  | 0 2   |     |     |
| Coal, hard .....   | 0 4   |     |     |

(Elevation, 1750' A. T., Aneroid.)

The Lower Kittanning is mined on the land of Mary L. Rogers at the schoolhouse  $\frac{1}{4}$  mile east of the Phillips mine, where it shows the following section:

|  | Ft. | In. |
|--|-----|-----|
| Slate, roof .....                      | ..  | ..  |
| Cannel slate .....0' 4½"               | }   | 3   |
| Coal .....2 0                          |     |     |
| Slate, gray.....0 1                    |     |     |
| Coal, 11" to .....1 0                  |     |     |
| Slate, gray .....                      | 0   | 3   |
| Concealed .....                        | 40  | 0   |
| Sandstone, massive, making cliff ..... | ..  | ..  |
| (Elevation, 1430' A. T., Aneroid.)     |     |     |

The coal is mined 2.2 miles southeast of Halleck, on Laurel run, where it has the following section:

|   | Ft. | In. |
|---|-----|-----|
| Sandstone, massive, Lower Freeport .....  | 10  | 0   |
| Coal .....0' 7 "                          | }   | 3   |
| Slate, gray.....0 0½                      |     |     |
| Coal .....0 8                             |     |     |
| Slate, gray.....0 7                       |     |     |
| Coal .....0 7                             |     |     |
| Slate, black.....0 3                      |     |     |
| Coal, bony .....0 4                       |     |     |
| Coal, soft .....0 6                       |     |     |
| Slate and concealed .....                 | 15  | 0   |
| Sandstone, massive, white .....           | ..  | ..  |
| (Elevation of coal, 1685 A. T., Aneroid.) |     |     |

The Lower Kittanning coal is mined 2 miles northwest of Gladesville, where Reger measured the following section:

**Samuel Frederick Mine, Lower Kittanning Coal.  
No. 89 on Map II.**

|                                    | Ft. | In. |
|------------------------------------|-----|-----|
| 1. Slate .....                     | ..  | ..  |
| 2. Coal .....1' 0"                 | }   | 5   |
| 3. Shale, gray .....0 4            |     |     |
| 4. Coal, good .....2. 6            |     |     |
| 5. Slate .....0 4                  |     |     |
| 6. Coal, good .....0 11            |     |     |
| 7. Slate .....                     | ..  | ..  |
| (Elevation, 1895' A. T., Aneroid). |     |     |

A sample collected from Nos. 2, 4 and 6 is published, as reported by Messrs. Hite and Krak, in the table of coal analyses under No. 89 (Lab. No. 651-H).

The coal was formerly mined along the Morgantown and Beverley pike at the road fork,  $\frac{1}{4}$  mile from the Preston county line. The mine is now abandoned, but, according to Reger, the mining section was about 5 feet.

The Lower Kittanning coal is mined along the same pike a short distance from the Preston line, where Reger measured the following section:

|  | Ft. | In. |
|--|-----|-----|
| 1. Shale, gray .....                       | ..  | ..  |
| 2. Coal, good.....0' 11" } .....           | 3   | 6   |
| 3. Shale, gray .....0 3 } .....            |     |     |
| 4. Coal, good .....2 4 } .....             |     |     |
| 5. Shale, gray and concealed .....         | 30  | 0   |
| 6. Fire clay .....                         | 5   | 0   |
| 7. Concealed .....                         | 13  | 0   |
| 8. Slate, black.....                       | 2   | 0   |
| 9. Fire clay, gray .....                   | 19  | 0   |
| 10. Slate, black .....                     | 1   | 0   |
| 11. Sandstone, white, soft, Homewood ..... | 20  | 0   |

(Elevation of coal, 1875' A. T., Aneroid.)

The intervals and thicknesses of the lower portion of this section are uncertain as the rapid dip of the measures prevented accurate measurement.

This coal is mined on the land of Wm. Morris on White-day creek,  $\frac{3}{4}$  mile northwest of Anita, and has there the following section, according to Reger:

|                                     | Ft. | In. |
|-------------------------------------|-----|-----|
| 1. Sandstone .....                  | ..  | ..  |
| 2. Shale, sandy .....               | 4   | 0   |
| 3. Slate, black .....               | 0   | 5   |
| 4. Slate, cannel .....0' 4" } ..... | 5   | 5   |
| 5. Coal, good .....1 2 } .....      |     |     |
| 6. Coal, bony.....0 10 } .....      |     |     |
| 7. Coal .....1 2 } .....            |     |     |
| 8. Bone .....0 1 } .....            |     |     |
| 9. Coal, good, soft ...1 10 } ..... |     |     |
| 10. Slate .....                     | ..  | ..  |

(Elevation, 1035' A. T., Aneroid.)

In Marion county the Lower Kittanning coal shows a good thickness at almost all points where its horizon appears above drainage. On lick run, one-eighth mile from Anita, Reger made the following section at a prospect opening:

|                             | Ft. | In. |
|-----------------------------|-----|-----|
| Sandstone .....             | 3   | 0   |
| Shale, brown .....          | 4   | 0   |
| Slate, black .....          | 1   | 0   |
| Coal .....2' 6" } .....     |     |     |
| Slate .....0 1 } .....      | 4   | 5   |
| Coal .....1 10 } .....      |     |     |
| Shale, gray .....           | 1   | 0   |
| Concealed .....             | 10  | 0   |
| Sandstone .....             | 5   | 0   |
| Concealed to Lick Run ..... | 5   | 0   |

(Elevation of coal, 1075' A. T., Aneroid.)

On Lick run, one-half mile east of Forksburg, the Lower Kittanning coal is found in good thickness. The following section was measured there by Reger:

**Marcellus Jolliffe Mine, Lower Kittanning Coal.  
No. 90 on Map II.**

|                              | Ft. | In. |
|------------------------------|-----|-----|
| 1. Shale, brown .....        | 5   | 0   |
| 2. Slate, black, cannel..... | 0   | 8   |
| 3. Coal .....2' 1" } .....   |     |     |
| 4. Slate .....0 1 } .....    | 5   | 2   |
| 5. Coal .....3 0 } .....     |     |     |

(Elevation, 1150' A. T., Aneroid.)

A sample was collected from Nos. 3 and 5 and its composition, etc., as reported by Messrs. Hite and Krak are given under No. 90 (Lab. No. 625-H) in the table of coal analyses.

The section of the coal at this mine bears some resemblance to the Upper Kittanning coal, since it has cannel slate at the top and carries only one slate parting, but the lowest member is much thicker than the lower bench of the Upper Kittanning. Aside from this important difference the coal was traced down Lick run to the Morris mine at Anita where the usual ten-inch streak of bony coal appears in the middle of the seam.

The Lower Kittanning was formerly mined at the road fork on Lick run, 1/2 mile southeast of Forksburg, but the mine had fallen shut and the section was mostly concealed.

This coal is mined extensively for local domestic use on the head of Prickett creek, one-fourth mile southeast of Samaria, where Reger secured the following section:



|                                    | Ft. | In.  |
|------------------------------------|-----|------|
| Sandstone, shaly .....             | 5   | 0    |
| Slate, black .....                 | 1   | 0    |
| Coal, good .....2' 0"              | }   | 4 10 |
| Slate .....0 1                     |     |      |
| Coal .....0 10                     |     |      |
| Coal, cannel .....0 7              |     |      |
| Coal, good .....1 10               |     |      |
| Slate, black .....0 1              |     |      |
| Coal .....0 3                      |     |      |
| (Elevation, 1230' A. T., Aneroid.) |     |      |

On Long run, one mile south of Samaria, the following section of this bed was obtained by Reger on the land of Jack Vincent:

|                                    | Ft. | In. |
|------------------------------------|-----|-----|
| Cannel slate .....                 | 0   | 8   |
| Coal .....1' 9"                    | }   | 4 2 |
| Slate .....0 1                     |     |     |
| Coal .....0 10                     |     |     |
| Cannel coal .....0 6               |     |     |
| Coal .....1 0                      |     |     |
|                                    |     |     |
| (Elevation, 1260' A. T., Aneroid.) |     |     |

On Prickett creek, 1.3 miles northwest of Hebron church, the Lower Kittanning coal has the following structure as measured by Reger:

|  | Ft. | In. |
|--|-----|-----|
| Shales, gray, silicious, finely bedded .....   | 10  | 0   |
| Cannel slate .....                             | 0   | 5   |
| Coal, soft .....1' 10"                         | }   | 4 4 |
| Slate .....0 2                                 |     |     |
| Coal, soft .....0 10                           |     |     |
| Slate, with numerous<br>plant fossils .....0 2 |     |     |
| Coal, blocky .....1 4                          |     |     |
| Concealed .....                                |     |     |
| (Elevation, 1240' A. T., Aneroid.)             |     |     |

On the head of Prickett creek, along the Winfield-Union district line, 1.8 miles southwest of Neel, Reger measured the following section of the coal on the land of Jacob Rogers:

|   | Ft. | In.  |
|---|-----|------|
| Sandstone, massive, steel gray, Lower Freeport... | 20  | 0    |
| Slate, gray .....                                 | 0   | 3    |
| Coal, slaty .....0' 10"                           | }   | 4 11 |
| Slate .....0 1                                    |     |      |
| Coal .....2 1                                     |     |      |
| Slate .....0 1                                    |     |      |
| Coal .....1 10                                    |     |      |
|   |     |      |
| (Elevation, 1280' A. T., Aneroid.)                |     |      |

On Dunham Lick run of Prickett creek the Lower Kittanning carries about three feet of **cannel coal** in its lower portion. A section of the coal measured by Reger on the land of Jacob Rogers, 1.6 miles northwest of Neel, shows the following structure:

**Jacob Rogers Mine, Lower Kittanning Coal.**  
**No. 92 on Map II.**

|                                       | Ft. | In. |
|---------------------------------------|-----|-----|
| 1. Sandstone, shaly .....             | 10  | 0   |
| 2. Shale, gray .....                  | 4   | 0   |
| 3. Coal, cannel, slaty. 0' 7" } ..... | 5   | 5   |
| 4. Coal, soft. .... 2 8 } .....       |     |     |
| 5. Slate, gray. .... 0 2 } .....      |     |     |
| 6. Coal, cannel .... 2 0 } .....      |     |     |
| 7. Concealed by water .....           | ..  | ..  |
| (Elevation, 1245' A. T., Aneroid.)    |     |     |

The composition of the sample collected from No. 6 of section, as reported by Messrs. Hite and Krak, is given under No. 92 (Lab. No. 610-H) in the table of coal analyses. The sample, which was collected by Reger, was taken from a freshly cleaned face of an old working abandoned many years ago. The coal is excessively high in ash and does not show the unusual amount of volatile matter which its appearance indicated. There was no physical evidence of oxidation, but it is possible that if a new working face had been available the coal would have shown a higher volatile content.

According to Jacob Rogers this coal was mined extensively before the Civil War and hauled by mules over a tram road to Hammond station on the Baltimore & Ohio Railroad, where it was shipped away and used for distilling oil and gas. The upper part of the coal was regarded as worthless and thrown on the dump where it was allowed to waste. The discovery of petroleum, about the time of the Civil War, caused the mine to be abandoned.

The same coal is mined at another opening on the land of Jacob Rogers, 1.2 miles east of Neel, where it has the following structure:

**Jacob Rogers Mine, Lower Kittanning Coal.  
No. 93 on Map II.**

|  | Ft. | In. |
|--|-----|-----|
| 1. Sandstone .....                           | 5   | 0   |
| 2. Shale, sandy .....                        | 7   | 0   |
| 3. Shale, dark .....                         | 0   | 6   |
| 4. Cannel slate .....                        | 0   | 4   |
| 5. Coal, soft .....3' 0" }                   | 6   | 1½  |
| 6. Slate, black .....0 1½ }                  |     |     |
| 7. Cannel coal .....3 0 }                    |     |     |
| 8. Black slate .....                         | 4   | 0   |
| 9. Fire clay, good .....                     | 5   | 0   |
| 10. Sandstone, gray and massive to run ..... | 5   | 0   |
| (Elevation of coal, 1255' A. T. Aneroid.)    |     |     |

The composition, calorific value and fuel ratio of the sample collected here by Reger from No. 5 are given under No. 93 (Lab. No. 627-H) and one collected from No. 7 under No. 93 (Lab. 628-H) in the table of coal analyses.

The extent of this cannel formation in the Lower Kittanning coal is uncertain. Northwest of Dunham Lick run, at Samaria, there is only 7 inches of cannel coal and west of Dunham Lick, on Long run, there is only 6 inches. South of Dunham Lick the two exposures examined on Prickett creek do not show cannel coal at all. About two miles east of mine No. 93 on Dunham Lick run, there is an old mine in Taylor county on Whiteday creek, ½ mile from the Marion county line that is reported to have produced cannel coal. This mine has been abandoned for many years so that a section could not be obtained. It is possible that a considerable body of cannel coal may be found beneath the hills east of Dunham Lick run.

The Lower Kittanning coal is mined on Grassy run, one-half mile east of Gath where Reger secured the following section:

**Owen Vincent Mine, Lower Kittanning Coal.  
No. 91 on Map II.**

|                                    | Ft. | In. |
|------------------------------------|-----|-----|
| 1. Cannel slate .....              | 0   | 7   |
| 2. Coal, good .....2' 0" }         | 4   | 9   |
| 3. Slate .....0 1 }                |     |     |
| 4. Coal, good .....2 8 }           |     |     |
| (Elevation, 1160' A. T., Aneroid.) |     |     |

The composition, etc., of the sample collected from Nos 2 and 4, as reported by Messrs. Hite and Krak, are given under No. 91 (Lab. No. 624-H) in the table of coal analyses.

This bed is mined on Grassy run, 1 mile east of Gath, where Reger made the following section, hand level measurement, that includes it:

|  | Ft.                   | In. |
|--|-----------------------|-----|
| Shale, brown .....                           | 6                     | 0   |
| Slate, black, cannely .....                  | 0                     | 7   |
| Coal, slaty .....2' 9"                       | } Lower Kittanning..4 | 11  |
| Coal, cannely .....0 4                       |                       |     |
| Slate .....0 1                               |                       |     |
| Coal .....1 6                                |                       |     |
| Slate .....0 1                               |                       |     |
| Coal .....0 2                                |                       |     |
| Shale, gray and concealed .....              | 27                    | 0   |
| Coal, Clarion, visible .....                 | 0                     | 6   |
| Fire clay, gray, with iron ore nuggets ..... | 19                    | 0   |
| Sandstone, massive, to run, Homewood .....   | 28                    | 0   |

(Elevation of Lower Kittanning coal, 1180' A. T., Aneroid).

The Lower Kittanning coal has been prospected extensively along the Tygart Valley river near the Marion-Taylor county line, where the Chestnut Ridge Anticline brings it above drainage. One-fourth mile east of Powell the coal has the following section in the river hill:

|   | Ft.     | In. |
|---|---------|-----|
| Sandstone, massive, Lower Freeport, visible.... | 25      | 0   |
| Shale, sandy, 12" to.....                       | 0       | 0   |
| Cannel slate.....                               | 0       | 6   |
| Coal .....2' 0"                                 | } ..... | 5   |
| Slate, black.....0 0½                           |         |     |
| Coal .....0 7                                   |         |     |
| Slate .....0 0½                                 |         |     |
| Coal .....0 10                                  |         |     |
| Slate, ½" to.....0 1                            |         |     |
| Coal, softer.....1 5½                           | 1       | 6   |
| Fire clay, visible.....                         | 1       | 6   |

(Elevation of coal, 995' A.T., Aneroid).

In Taylor county the Lower Kittanning coal is exposed along the Tygart Valley river at several points. It was once mined on Meetinghouse run, ½ mile southeast of Powell, but the mine had fallen shut and could not be measured.

This coal was once mined on the land of C. N. Mason, ¾ mile southeast of Valley Falls, but the mine had fallen shut and its section could not be obtained. The coal is locally

known as the "Five-Foot" seam to distinguish it from the Upper Kittanning which is called the "Four-Foot".

The Lower Kittanning coal is mined on a commercial scale by the Winona Coal & Coke Company at Coffman Station. This mine will be described in detail in Chapter XII.

In the southern part of Taylor county this coal appears above drainage and is mined commercially at Cecil. Its character will be discussed in Chapter XII.

An exposure measured at the Barbour county line,  $\frac{3}{4}$  mile southeast of Cecil, on the land of Granville Male shows the following section:

|  | Ft. | In. |
|--|-----|-----|
| Sandstone, massive, Lower Freeport, visible..... | 5   | 0   |
| Shale, sandy.....                                | 3   | 0   |
| Slate, black.....                                | 2   | 0   |
| Coal, soft.....2' 7" } .....                     | 5   | 5   |
| Coal, bony.....0 7 }                             |     |     |
| Coal, soft.....2 3 }                             |     |     |
| Fire clay and concealed.....                     | 20  | 6   |
| Sandstone, massive, pebbly, white, Homewood....  | 40  | 0   |

(Elevation of coal, 1145' A. T., Aneroid).

This coal is mined on the south side of Sandy creek, in Barbour county,  $\frac{3}{4}$  mile southwest of Hiram, where it has the following section:

### Harvey Phillips Mine, Lower Kittanning Coal.

#### No. 96 on Map II.

|   | Ft. | In. |
|---|-----|-----|
| 1. Sandstone, massive, coarse and pebbly, with fossil plants, Lower Freeport..... | 40  | 0   |
| 2. Fire clay.....2' to 3  | 3   | 0   |
| 3. Coal .....0' 5" } .....  | 5   | 7   |
| 4. Slate, black.....0 2 }   |     |     |
| 5. Coal, soft.....1 3 }   |     |     |
| 6. Slate, 0 $\frac{1}{2}$ " to.....0 1 }  |     |     |
| 7. Coal .....1 1 }  |     |     |
| 8. Slate, gray, 2" to.....0 4 }   |     |     |
| 9. Coal, bony.....0 5 }   |     |     |
| 10. Coal, good.....1 10 }   |     |     |
| 11. Slate .....   |     |     |

(Elevation, 1220' A.T., Aneroid).

The composition, etc., of the samples collected from Nos.

5, 7 and 10 of the section are given under No. 96 (Lab. No. 575-H) in the table of coal analyses.

In northeastern Taylor county the Lower Kittanning is mined on Laurel run, 1 mile northwest of Irondale. A section measured here shows the following structure:

**Chas. Sapp Mine, Lower Kittanning Coal.—No. 94 on Map II.**

|                        | Ft. | In. |   |             |
|------------------------|-----|-----|---|-------------|
| 1. Coal, slaty.....    | 0   | 8   | } | ..... 8' 9" |
| 2. Shale, gray.....    | 2   | 0   |   |             |
| 3. Coal, 8" to.....    | 0   | 11  |   |             |
| 4. Slate, gray, hard.. | 0   | 5   |   |             |
| 5. Coal, bony.....     | 0   | 7   |   |             |
| 6. Slate, black.....   | 0   | 11  |   |             |
| 7. Coal, soft.....     | 2   | 3   |   |             |
| 8. Slate, black.....   | 0   | 6   |   |             |
| 9. Coal, bony.....     | 0   | 6   |   |             |
| 10. Fire clay .....    |     |     |   |             |

(Elevation, 1355' A. T., Hand Level).

Nos. 8, 9 and 10 were concealed, but they were furnished by Charles Sapp. Reger collected a sample from No. 7 the composition of which, as reported by Messrs. Hite and Krak is given under No. 94 (Lab. No. 602-H) in the table of coal analyses.

This seam is mined for domestic use one-half mile northwest of Hardman Station, where Reger measured the following section:

|   | Ft.     | In. |
|---|---------|-----|
| Sandstone .....                           | 20      | 0   |
| Shale, gray .....                         | 5       | 0   |
| Limestone, gray, thickness concealed..... | 0       | 0   |
| Concealed and shale.....                  | 33      | 0   |
| Sandstone, shaly.....                     | 15      | 0   |
| Concealed .....                           | 20      | 0   |
| Slate, black.....                         | 1       | 0   |
| Coal .....                                | 0' 11 " | }   |
| Slate .....                               | 0 2     |     |
| Coal .....                                | 1 9     |     |
| Slate .....                               | 0 0¼    |     |
| Coal .....                                | 0 1     |     |

(Elevation of coal, 1123' A. T., Hand Level).

A further discussion of the Lower Kittanning coal, with estimates of its probable tonnage, will be given in the chapter on Coal.

### The Lower Kittanning Fire Clay.

Immediately under the Lower Kittanning coal there is a fire clay that has a wide distribution in Western Pennsylvania and Ohio. It is also mined extensively in Hancock county, West Virginia, where it is used for building brick and paving blocks. This clay has a good exposure in Union district, Monongalia county,  $\frac{1}{2}$  mile southeast of Laurel Iron Works, where the following section was made by hand level:

|   | Ft. | In. |
|---|-----|-----|
| Slate, gray, visible.....                       | 1   | 0   |
| Coal .....2 6 "                                 |     |     |
| Slate, black.....0 0½                           |     |     |
| Coal .....0 6½                                  |     |     |
| } Upper Kittanning..                            |     |     |
| Fire clay and concealed.....                    | 23  | 0   |
| Shale, sandy.....                               | 5   | 0   |
| Coal, Lower Kittanning, 6" to.....              | 2   | 0   |
| Slate .....                                     | 1   | 6   |
| Fire clay, flinty, Lower Kittanning, 3' to..... | 4   | 0   |
| Concealed .....                                 | 5   | 0   |
| Limestone .....                                 | 1   | 0   |

A sample was collected from the Lower Kittanning fire clay and its analysis is reported as follows by Messrs. Hite and Krak under Lab. No. 638-H:

|   | Per cent. |
|---|-----------|
| Silica (Si O <sub>2</sub> ).....                      | 54.02     |
| Ferric Iron (Fe <sub>2</sub> O <sub>3</sub> ).....    | 4.17      |
| Alumina (Al <sub>2</sub> O <sub>3</sub> ).....        | 19.09     |
| Lime (Ca O).....                                      | 6.10      |
| Magnesia (Mg O).....                                  | 1.92      |
| Sodium (Na <sub>2</sub> O).....                       | 0.37      |
| Potassium K <sub>2</sub> O).....                      | 2.54      |
| Titanium (Ti O <sub>2</sub> ).....                    | 0.50      |
| Phosphoric Acid (P <sub>2</sub> O <sub>5</sub> )..... | 0.76      |
| Moisture .....  | 0.37      |
| Loss on ignition.....                                 | 9.74      |
| Total .....   | 99.58     |

The analysis shows such an excess of lime oxide that it is doubtful whether an attempt to use the clay for brick would prove successful.

At Hammond, Marion county, a fire clay occurs in the river hill that apparently correlates with the Lower Kittanning fire clay. It is 5 feet thick and comes 80 feet above the Ham-

mond fire clay that is now being used by the Hammond Fire Brick Company. The Lower Kittanning fire clay was formerly quarried here for brick making, but the quarry was abandoned in 1912.

### **The Vanport (Ferriferous) Limestone.**

In western Pennsylvania and Ohio a limestone occurs below the Lower Kittanning fire clay that carries marine fossils and sometimes has a thickness of 10 to 15 feet. It is usually covered with a thin layer of iron ore that is often mined for furnace use. This limestone was not observed in the territory of this report. The Vanport iron ore was observed one-half mile southeast of Dellslow, Monongalia county, and at the Eureka schoolhouse on Whiteday creek in Marion county near the Monongalia line. Its character will be discussed in Chapter XIII.

### **The Clarion Sandstone.**

The **Clarion sandstone**, which belongs beneath the Ferriferous limestone and is prominent in parts of Pennsylvania and in Garrett county, Maryland, was not observed above drainage in Monongalia, Marion or Taylor counties, but it appears in the sections for Morgantown and Webster.

### **The Clarion Coal.**

The **Clarion coal**, which was named from its occurrence in Pennsylvania, is the lowest bituminous member of the Allegheny series that has been observed in the territory of this report. Its crop may be followed closely on Map II by observing the base of the Allegheny series which is almost identical with the Clarion coal. Its thickness and stratigraphic relation may be seen by reference to the sections for Morgans Run, Beaverhole, Morgantown, Powell, and Irondale.

The Clarion coal has been mined in Preston county on Bee run, 0.5 mile south of Cheat river and 1.3 miles southeast



of Beaverhole. A section measured there shows the following structure:

**Zacheus Gibson Mine, Clarion Coal.—No. 99 on Map II.**

|  | Ft. | In. |
|--|-----|-----|
| 1. Sandstone, massive.....                 |     |     |
| 2. Coal .....2' 6"                         | }   | 6   |
| 3. Slate, black, ½" to.0 1                 |     |     |
| 4. Coal .....1 0                           |     |     |
| 5. Slate, gray .....0 8                    |     |     |
| 6. Coal .....2 4                           |     |     |
| 7. Fire clay and concealed.....            |     |     |
| 8. Sandstone, massive, Homewood.....       |     |     |
| (Elevation of coal, 1525' A. T., Aneroid). |     |     |

The composition, calorific value and fuel ratio of the sample collected from Nos. 2, 4 and 6, as reported by Messrs Hite and Krak are given under No. 99 (Lab. No. 634-H) in the table of coal analyses.

The same coal has been mined at several other localities near the Gibson mine, but its discussion will be given in the report on Preston county.

The Clarion coal was noted at the Morgan-Clinton district line, 1.2 miles northwest of Rohr, where it is 4 to 5 feet thick and slaty. This coal is mined on Laurel run, 2.1 miles southwest of Gladesville, and one-half mile from the Monongalia-Taylor line, where it has the following section:

|                                    | Ft. | In. |
|------------------------------------|-----|-----|
| Slate, gray, hard.....             | 2   | 0   |
| Coal .....0' 6"                    | }   | 5   |
| Slate, gray, hard, 0" to.0 1       |     |     |
| Coal .....0 10                     |     |     |
| Slate, dark .....0 7               |     |     |
| Coal .....1 0                      |     |     |
| Slate, dark.....0 10               |     |     |
| Coal .....1 9                      |     |     |
| Slate .....                        |     |     |
| (Elevation, 1530' A. T., Aneroid). |     |     |

The Clarion coal is visible along the public road where Laurel run crosses the Monongalia-Taylor line.

This coal has been prospected recently on a branch of Laurel run, Taylor county, 1.2 miles northwest of Irondale, where Reger secured the following section on the J. B. Watson farm:

|                   |       | Ft. | In. |
|-------------------|-------|-----|-----|
| Sandstone .....   |       | 12  | 0   |
| Slate .....       |       | 1   | 4   |
| Coal .....        | 1' 7" | }   | 5   |
| Slate .....       | 0 0½  |     |     |
| Coal ..           | 0 6   |     |     |
| Slate, black..... | 1 0   |     |     |
| Coal, bony.....   | 0 10  |     |     |
| Slate, gray.....  | 0 11  |     |     |
| Coal .....        | 0 3   |     |     |
| Concealed .....   |       |     | 1½  |

(Elevation, 1336' A. T., Aneroid).

In **Marion county** no Clarion coal of commercial thickness was found. Its horizon appears in a section published under the description of the Lower Kittanning coal on Grassy run, one mile east of Gath, where it is 6 inches thick.

In **Taylor county**, in addition to the exposure noted above on Laurel run, the Clarion coal is recorded in the Martha Tucker gas well, Map No. 697, 1 mile south of Valley Falls, where it is 7 feet thick.

### The Clarion Fire Clay.

In western Pennsylvania and in Hancock county, West Virginia, a bed of fire clay occurs under the Clarion coal that has been named the **Clarion fire clay**. This clay was not observed above drainage at any point, but the record of the Gamble Boring (337), published in the section for Rock Forge, Monongalia county, shows 11.6 feet of fire clay under the Clarion coal. The horizon is usually occupied by sandy shales when the Clarion coal does not rest directly on the Homewood sandstone.

# CHAPTER IX.

## STRATIGRAPHY—POTTSVILLE SERIES

The Pottsville series, or Pottsville Conglomerate, which lies next under the Allegheny, was named by Prof. J. P. Lesley from its occurrence at Pottsville, Pennsylvania, where it has a striking development, being composed of alternate anthracitic coal and sandstone members. The sandstones are mere masses of quartz pebbles, ranging in size from one-eighth to two inches in diameter, cemented together into irregular strata.

In the territory of this report the Pottsville series retains in only a slight degree the features that give it prominence at Pottsville. Here it has lost much of its pebbly character, while the coals are bituminous and usually too thin to be economically important.

An ideal section of the Pottsville series for this part of West Virginia would show the following:

### General Section, Pottsville Series in Northern West Virginia.

|  | Thickness. | Total. |
|--|------------|--------|
|  | Feet.      | Feet.  |
| Sandstone, massive, gray with occasional quartz pebbles, Homewood.....                 | 50         | 50     |
| Coal, Tionesta.....  | 1          | 51     |
| Fire clay, flinty, Mt. Savage.....   | 5          | 56     |
| Fire clay and sandy shales with iron ore...  | 25         | 81     |
| Coal, streak.....  | 0          | 81     |
| Fire clay and shale.....   | 5          | 86     |
| Coal, streak.....  | 0          | 86     |
| Fire clay, flinty, Hammond.....  | 4          | 90     |
| Coal, Upper Mercer.....  | 5          | 95     |
| Shales, brown, sandy.....  | 10         | 105    |
| Limestone, ferriferous, hard, Lower Mercer..   | 1          | 106    |
| Coal, Lower Mercer.....  | 1          | 107    |
| Fire clay and shales.....  | 1          | 108    |
| Sandstone, hard, massive, white, with angular quartz pebbles, Upper Connoquenessing... | 75         | 183    |
| Coal, Quakertown.....  | 2          | 185    |

|  | Thickness. | Total. |
|--|------------|--------|
|  | Feet.      | Feet.  |
| Shale, sandy.....  | 15         | 200    |
| Sandstone, hard, massive, white, with some pebbles, Lower Connoquenessing..... | 60         | 260    |
| Coal, Sharon, streak.....  | 0          | 260    |
| Shale, sandy.....  | 15         | 275    |
| Sandstone, massive, pebbly, Sharon.....  | 25         | 300    |

The pebbles of the Pottsville series in this region are angular and small. The only evidence of transportation is that due to rolling friction, as none of them are flattened or oblong, the only abrasion being at the corners.

No evidence of animal life, either of marine or fresh water origin was observed in these rocks, although a minute investigation of this phase was not made. It may be considered certain, however, that there are not enough fossils in the series to make them easily available in stratigraphic determinations.

The plant life in the Pottsville series is abundant. *Lepidodendra* and *sigillariae*, which were not often observed in the rocks above the Pottsville, are present in great numbers and afford the stratigrapher a fairly reliable means of tracing the line between the Allegheny and Pottsville series, their size and peculiar forms making them easy to recognize.

The succession and character of the Pottsville rocks are given in numerous general sections in Chapter IV. Additional sections of the Pottsville will now be given, affording a more detailed knowledge of these measures.

A section showing the lower sandstone members of the Pottsville series, made by Reger south of Lick Run Station on the M. & K. Railroad in Monongalia county, shows the following:

#### Lick Run Section, Pottsville Series.

|  | Thickness. | Total. |
|--|------------|--------|
|  | Feet.      | Feet.  |
| Sandstone, massive, white, Upper Connoquenessing .....   | 75         | 75     |
| Concealed .....  | 20         | 95     |
| Sandstone, very soft, white, Lower Connoquenessing ..... | 40         | 135    |
| Concealed .....  | 40         | 175    |
| Sandstone, flaggy, gray, hard, white, Sharon             | 15         | 190    |
| Concealed to Mauch Chunk reds.....                       | 35         | 225    |

(Elevation of basal member, 1935' B-A. T.)

The following section, showing the upper portion of the Pottsville, was measured south of the Tygart Valley river at Valley Falls, in Taylor county:

### Valley Falls Section.

|  | Thickness. | Total. |
|--|------------|--------|
|  | Feet.      | Feet.  |
| Sandstone, massive, Homewood, visible....                      | 20         | 20     |
| Shale, dark, Tionesta coal horizon.....                        | 5          | 25     |
| Shale, sandy.....  | 10         | 35     |
| Fire clay, hard, laminated, Mt. Savage.....                    | 10         | 45     |
| Concealed .....  | 3          | 48     |
| Fire clay, hard, laminated.....                                | 10         | 58     |
| Shale, dark.....   | 4          | 62     |
| Coal, hard.....1' 4" to  | 1          | 63     |
| Sandstone, massive.....  | 20         | 83     |
| Coal, bony .....0' 4" } Upper Mercer                           |            |        |
| Slate, gray.....0 2 } Mine No. 101                             |            |        |
| Coal, bony.....0 7 } on Map II.. 5                             |            | 88     |
| Slate, gray.....0 2 }  |            |        |
| Coal, soft.....2 0 }   |            |        |
| Slate, gray.....2" to 0 3 }                                    |            |        |
| Coal, blocky.....1 6 }   |            |        |
| Fire clay, friable.....  | 6          | 96     |
| Sandstone, visible.....  | 1          | 97     |
| Concealed to Falls sandstone, Upper Conno-<br>quenessing ..... | 18         | 115    |
| (Elevation of Upper Mercer coal, 1000' A. T., Hand Level).     |            |        |

## DESCRIPTION OF POTTSVILLE FORMATIONS.

### The Homewood Sandstone.

The **Homewood sandstone**, which is the upper member of the Pottsville series, was named by I. C. White from its outcrop in Beaver county, Pennsylvania, where it reaches the great thickness of 150 feet. In the territory of this report it seldom exceeds 50 feet and is often less than that. It is usually light gray in color and medium hard, but often weathers white on exposure and becomes so soft that it crumbles easily under the blow of a hammer. It has an abundant fossil record of plant life, most of the forms being the coarser ones such as lepidodendra and sigillariae. It sometimes contains quartz pebbles, but this feature is not always found. It often carries water when under drainage and has

produced both oil and gas, being known to the drillers as the "Second Cow Run sand".

The Homewood sandstone crop coincides with that of the base of the Allegheny series which is shown on Map II. In Monongalia county it crops in Union, Morgan and Clinton districts; in Marion it crops only in Winfield and Union; in Taylor its crop is mainly in Booths Creek and Fetterman districts, but it rises above drainage also along the Tygart Valley river at the southeast edge of the county in Knottsville district.

The stratigraphic position and thickness of the Homewood sandstone may be found by reference to the geologic sections for Mont Chateau, Quarry Run, Beaverhole, Morgantown, Sturgisson, Downs, Montana Mines, Powell, Webster, Irondale and Stonehouse.

In Monongalia county the Homewood sandstone crops at numerous points along the Chestnut Ridge Anticline, and is a prominent feature near Sand Spring along the Preston county line. On Cheat river it rises above drainage at the island north of Mont Chateau and the eastward rise of the strata carries it into the air two miles east of that point. At Dellslow, on the M. & K. Railroad, the Homewood sandstone appears above drainage near the mouth of Tibbs run and makes prominent cliffs on either side of Deckers creek. On the south side of the creek its outcrop was followed continuously by Reger from Dellslow three miles southeastward to Mack, where it is near the summit of the lofty hills. It passes under drainage at Cascade, Preston county, one mile S E from the Monongalia line. It is a prominent feature along the Beverly pike at the head of Field creek, three miles northwest of Gladesville, where Reger secured the following data on the Hiram Miller farm:

|  | Ft. |
|--|-----|
| Coal, slaty, thickness concealed, Clarion..... | 0   |
| Sandstone, massive, white, Homewood.....       | 25  |

The sandstone is very soft, medium grained and free from pebbles. A sample collected here under Laboratory No. 653H,

gave the following results, according to Messrs. Hite and Krak:

|  | Per cent.    |
|--|--------------|
| Silica (Si O <sub>2</sub> ).....                   | 99.02        |
| Ferric Iron (Fe <sub>2</sub> O <sub>3</sub> )..... | 0.03         |
| Alumina (Al <sub>2</sub> O <sub>3</sub> ).....     | 0.44         |
| <b>Total</b> .....                                 | <b>99.49</b> |

In Marion county the Homewood sandstone appears above drainage on Prickett creek along the Winfield-Union district line. Its outcrop there is not a prominent feature and there is not the usual amount of talus from it in the streams. It crops along the Tygart Valley river between Powell and Coffman station, and is often 40 to 50 feet thick, pebbly, and forms cliffs in that region.

In Taylor county it crops in Booths Creek district opposite the line of outcrop named for Marion county. Near Cecil, on the Tygart Valley river, it rises above drainage one-fourth mile west of the Barbour line, where it is 40 feet thick, white, pebbly and comes 20 feet under the Lower Kittanning coal. Its crop extends up Sandy creek one mile above the mouth of the creek. Northwest of Irondale it crops along Laurel run, where it may be seen at numerous points near drainage.

### The Tionesta Coal.

Between the Homewood and Upper Connoquenessing sandstones several coals appear that have been named collectively the **Mercer Group** by Pennsylvania geologists, from their outcrop in Mercer county in that State. In the territory of this report five coal seams were found in this interval, all of which appear in the section for Powell in Chapter IV. This section represents the maximum development, as at other points only one or two coals were usually found.

The first of the Mercer group of coals, which lies immediately under the Homewood sandstone, was named the **Tionesta** by the geologists of the First Geological Survey of Pennsylvania. In Somerset county, Pennsylvania, it was called the **Mt. Savage** coal and the same title was given to it by Dr. Martin in Garrett county, Maryland.

The Tionesta coal has but little scientific, and no commercial importance, in the territory of this report. It appears in the geologic sections published in Chapter IV for Rohr and Powell. It was observed at a few points in Morgan district, Monongalia county, along the Chestnut Ridge Anticline. On the Kingwood pike,  $1\frac{1}{4}$  miles southwest of Mack, it has the following section:

|  | Ft. | In. |
|--|-----|-----|
| Sandstone, white, massive, pebbly, Homewood... | 60  | 0   |
| Concealed .....                                | 5   | 0   |
| Coal, slaty, Tionesta.....                     | 1   | 3   |
| (Elevation of coal, 1980' A. T., Aneroid).     |     |     |

### The Mt. Savage Fire Clay.

Directly beneath the Tionesta coal a flint fire clay often occurs. It was named the **Mt. Savage** from its outcrop at Savage Mountain, Somerset county, Pennsylvania, where it has been mined extensively. In that locality and in Garrett county, Maryland, it is used, along with the plastic clay that occurs with it, for fire brick and other purposes where a clay with refractory qualities is needed.

In the territory of this report the Mt. Savage fire clay is not generally present, but its outcrop was noted in a few places. In the geologic section for Powell, it is noted immediately under the Tionesta coal where it is 6 feet thick, but of doubtful purity.

In Monongalia county, southeast of Sturgis, Reger reports it as occurring in a few places immediately over the Upper Mercer coal where it is about 5 feet thick but impure as it contains nuggets of iron ore. Its section there will be given under the discussion of Upper Mercer coal.

It is not probable that the Mt. Savage fire clay will prove to be of much economic importance as the fact that talus from it was seldom seen in the region of its crop indicates that it is not usually present.

### The Hammond Fire Clay.

At Hammond, Marion county, a fire clay occurs that has been mined extensively and manufactured into fire brick by



the Hammond Fire Brick Company. By reference to the Powell section it may be seen that this fire clay is separated from the Mt. Savage fire clay by a small seam of coal, a fact that proves conclusively that it is a separate horizon. Since this clay has not been previously named in any official publications, it will be styled the **Hammond Fire Clay**.

The clay worked at this horizon at the mine of the above mentioned company at Hammond has the following section descending:

|                          | Ft. |
|--------------------------|-----|
| Flint clay, 2' to.....   | 5   |
| Plastic clay, 6' to..... | 8   |

The chemical composition and physical properties of each type of clay, along with a description of the brick plant and mine at this place are given on pages 220-222 of Vol. III of the State Survey reports. Therein the clay has been erroneously assigned to the Lower Kittanning horizon, as will appear from a study of the Powell section, page 145.

The Hammond Fire clay is evidently a replacement of the Upper Mercer coal and since it represents an abnormal condition of the strata, will not likely prove to be of wide extent. It was observed only along the Tygart Valley river in the region of Powell, Hammond and Valley Falls. The same clay was noticed on Lost run, near its mouth, where it was 2 feet thick.

### The Upper Mercer Coal.

The **Upper Mercer coal**, which underlies or replaces the Hammond fire clay is the most important of the entire Mercer group. It is usually multiple-bedded, having such a variable number of slate and shale partings that no type section would represent it. The many partings detract greatly from its value as it is impossible to mine the coal without mixing some of the impurities with it.

The crop of the Upper Mercer coal is not shown on Map II, but it can easily be determined at any point by placing it about 90 feet below the base of the Allegheny series as shown

on Map II. It rises to the surface in eastern Monongalia county, eastern Marion and northern Taylor.

The stratigraphic position of this coal is shown in the geologic section for Powell, where it has a good development. It appears in a few oil well records, but aside from its nominal thickness, as recorded by the drillers, its extent and value are too speculative for intelligent discussion.

In **Monongalia county** the Upper Mercer coal was once prospected on the land of John Shaffer, 1.5 miles northwest of Rohr, but the opening was apparently unsuccessful.

This bed has been mined on the land of Robert Keener,  $\frac{3}{4}$  mile southwest of Sturgisson, where Reger measured the following section:

|  | Ft. | In. |
|--|-----|-----|
| Shale, gray with iron ore at base..... | 3   | 0   |
| Fire clay, flinty, Mt. Savage?.....    | 7   | 0   |
| Slate, black.....0' 3" )               |     |     |
| Coal, medium, hard, good .....1 7 )    | 4   | 2   |
| Shale, gray 0' 6" to...0 10            |     |     |
| Coal, good, 1' 0" to...1 6             |     |     |
| Pavement?                              |     |     |

(Elevation, 2015' A. T., Aneroid).

Whether the fire clay in the section above is the Mt. Savage or Hammond is open to question, but it is named as the Mt. Savage because the Hammond fire clay and the Upper Mercer coal do not usually appear in good thickness at the same point.

On the land of George Cohens, 0.8 mile westward from Mack, Reger obtained the following section of the Upper Mercer coal:

|   | Ft. | In. |
|---|-----|-----|
| Fire clay, flinty, impure, Mt. Savage?..... | 5   | 0   |
| Coal, soft .....1' 7" )                     |     |     |
| Shale, gray.....1 8                         |     |     |
| Coal, soft.....0 10 )                       | 7   | 9   |
| Shale, gray.....2 2                         |     |     |
| Coal, hard.....1 6                          |     |     |

(Elevation, 1995' A. T., Aneroid).

On the land of George Wolf,  $\frac{1}{4}$  mile southwest of Mack, Reger measured the following section of the Upper Mercer coal at a mine that is now abandoned:

|   | Ft.     | In. |
|---|---------|-----|
| Sandstone, massive, Homewood.....           |         |     |
| Concealed with streaks of coal at base..... | 20      | 0   |
| Draw slate, visible.....                    | 0       | 6   |
| Coal, soft.....1' 0"                        | } ..... | 5   |
| Shale, gray.....1 5                         |         |     |
| Coal, soft.....0 10                         |         |     |
| Slate, black, hard....0 1                   |         |     |
| Shale, gray.....1 3                         |         |     |
| Coal, hard.....1 1                          |         |     |
| Concealed pavement?                         |         |     |

(Elevation of coal, 2160' A. T., Aneroid).

The three foregoing sections show that the Upper Mercer coal in this locality has an exceptionally good development and will afford much valuable fuel.

In Clinton district, on the head of Booth creek, one mile north of Halleck, the Upper Mercer coal has been prospected on the land of Elijah McCray, where it shows the following section:

|   | Ft.     | In. |
|---|---------|-----|
| Sandstone, coarse, white, pebbly, Homewood..... | 50      | 0   |
| Concealed .....                                 | 5       | 0   |
| Shale, dark and sandy, laminated.....           | 10      | 0   |
| Coal .....1' 4 "                                | } ..... | 3   |
| Slate, gray.....0 0½                            |         |     |
| Coal .....0 7                                   |         |     |
| Coal, bony.....0 4                              |         |     |
| Slate, gray.....1 0                             |         |     |
| Coal, slaty.....0 6½                            |         |     |
| Fire clay.....                                  | 2       | 0   |
| Concealed to Booth Creek.....                   | 10      | 0   |

(Elevation of coal, 1470' A. T., Aneroid).

In the same district, on the head of Booth creek, 2.4 miles southeast of Clinton Furnace, the Upper Mercer coal was prospected and tested thoroughly by George Gilmore on the land of Jacob Keys, formerly known as the Berkshire tract, where Reger secured the following data:

**Jacob Keys Mine, Upper Mercer Coal.—No. 100 on Map II.**

|   | Ft. | In. |
|---|-----|-----|
| 1. Sandstone, massive, making cliff, Homewood                           |     |     |
| 2. Concealed, black slate at base.....                                  | 60  | 0   |
| 3. Coal, good.....1' 1 "  |     |     |
| 4. Slate .....0 0½  |     |     |
| 5. Coal, good.....2 0   |     |     |
| 6. Shale, gray, hard.1 6  |     |     |
| 7. Coal, very slaty<br>and impure<br>with streaks<br>of sulphur.....1 6 | 9   | 5½  |
| 8. Coal, hard.....0 6   |     |     |
| 9. Slate .....2 0   |     |     |
| 10. Coal .....0 10  |     |     |

(Elevation, 1640' A. T., Aneroid).

Nos. 9 and 10 of section were concealed, but supplied by Mr. Mitchell who worked in the mine. A sample was collected from Nos. 3, 5, and 8, the composition of which, as reported by Messrs. Hite and Krak, is given under No. 100 (Laboratory No. 652-H) in the table of coal analyses.

This coal was prospected by Granville Brown, one-half mile northeast of the McCray opening, but the presence of water prevented a thorough test.

The two sections and the Brown prospect indicate the presence of a considerable body of Upper Mercer coal in Clinton district between the headwaters of Booth creek and Field creek.

In Marion county the Upper Mercer coal appears on Grassy run, in Union district, one-half mile northwest of Samaria, where it has the following section:

|                                   | Ft. | In. |
|-----------------------------------|-----|-----|
| Slate shale, dark, laminated..... | 15  | 0   |
| Sandstone, massive.....           | 4   | 0   |
| Coal .....1' 0"                   |     |     |
| Shale, gray.....1 6               |     |     |
| Coal .....0 3                     | 4   | 1   |
| Shale, gray.....0 6               |     |     |
| Coal .....0 10                    |     |     |
| Fire clay.....                    | 3   | 0   |
| Sandstone, massive, to run.....   | 8   | 0   |

(Elevation of coal, 1030' A. T., Aneroid).

The coal here has too much slate to make it of value for mining purposes.

One-fourth mile south of Samaria, on Long run, a hole was sunk through the Upper Mercer coal which lies just below drainage at that point. The opening was full of water and the character of the coal could not be obtained.

This bed was once mined on a commercial scale by the Powell Coal & Coke Company, on the Tygart Valley river at Powell. There the coal is only 6 feet above the river and it was mined by a slope. The mine is abandoned and had fallen shut, but Mr. R. W. Keener, watchman, gave the following section:

|                               | Ft. | In. |
|-------------------------------|-----|-----|
| Slate .....                   |     |     |
| Coal .....3' to 4' 0" } ..... | 9   | 6   |
| Slate .....1 6 } .....        |     |     |
| Coal .....3' to 4 0 } .....   |     |     |

(Elevation, 887' A. T., Hand Level).

Three-fourths mile west of Hammond the Upper Mercer coal has the following section:

|                                      | Ft. | In. |
|--------------------------------------|-----|-----|
| Fire clay.....                       |     |     |
| Coal, bony, 18".....to 2' 0" } ..... |     |     |
| Slate, black.....0 2 } .....         | 5   | 5   |
| Coal, soft.....2 3 } .....           |     |     |
| Slate, black, 1" to.....0 2 } .....  |     |     |
| Coal, blocky, hard....0 10 } .....   |     |     |
| Fire clay, medium.....               | 3   | 0   |
| Sandstone, flaggy, dark.....         | 4   | 0   |
| Shale, sandy and hard.....           | 5   | 0   |
| Shale, sandy, softer.....            | 5   | 0   |
| Limestone, ferriferous, hard.....    | 0   | 6   |

(Elevation of coal, 945' A. T., Aneroid).

On Glady creek, 0.8 mile east of Hammond, the Upper Mercer coal is mined and has the following section:

|                                  | Ft. | In. |
|----------------------------------|-----|-----|
| Coal .....0' 10" } .....         |     |     |
| Slate, black.....0 2 } .....     |     |     |
| Coal, slaty.....1 6 } .....      | 9   | 4   |
| Slate, dark gray.....0 6 } ..... |     |     |
| Coal, slaty.....1 0 } .....      |     |     |
| Coal, soft.....2 4 } .....       |     |     |
| Slate, black.....0 3 } .....     |     |     |
| Coal, harder.....2 9 } .....     |     |     |

(Elevation, 1080' A. T., Aneroid).

In Taylor county the following section of the Upper Mercer coal was measured, 1.3 miles southwest of Valley Falls, at an old mill on the Charles Barker property:

|   | Ft.     | In. |
|---|---------|-----|
| 1. Sandstone, massive, visible.....               | 10      | 0   |
| 2. Shale, sandy.....                              | 1       | 6   |
| 3. Limestone, very ferriferous, 6" to.....        | 0       | 8   |
| 4. Shale, gray, with large boulders of iron ore.. | 4       | 0   |
| 5. Limestone, ferriferous.....                    | 0       | 4   |
| 6. Shale, sandy, dark.....                        | 1       | 0   |
| 7. Sandstone, massive.....                        | 12      | 0   |
| 8. Shale, dark, sandy, with fossil plants.....    | 3       | 0   |
| 9. Coal .....0' 2"                                | } ..... | 4   |
| 10. Slate, gray.....0 2                           |         |     |
| 11. Coal, bony.....0 3                            |         |     |
| 12. Coal .....2 0                                 |         |     |
| 13. Coal, bony.....0 2                            |         |     |
| 14. Shale, gray.....0 5                           |         |     |
| 15. Coal .....0 4                                 |         |     |
| 16. Shale, with streaks<br>of coal .....0 8       |         |     |
| 17. Shale, hard.....                              | 2       | 0   |
| 18. Sandstone to run.....                         | 2       | 6   |

(Elevation of coal, 1005' A. T., Aneroid).

A sample of the ferriferous limestone, No. 3 of section, was collected and its partial analysis as reported by Messrs. Hite and Krak under Laboratory No. 591-H is as follows:

|                                  | Per cent. |
|----------------------------------|-----------|
| Silica (Si O <sub>2</sub> )..... | 17.45     |
| Metallic Iron.....               | 41.11     |
| Lime (Ca O).....                 | 1.76      |
| Sulphur .....                    | 0.89      |
| Phosphorus .....                 | 0.82      |

At an exposure of the Upper Mercer coal along the public road, ½ mile southeast of Valley Falls on the south side of the river, Reger measured the following section:

|                                  | Ft.     | In. |
|----------------------------------|---------|-----|
| Sandstone, massive, visible..... | 15      | 0   |
| Coal, slaty.....1' 1 "           | } ..... | 4   |
| Slate .....0 0½                  |         |     |
| Coal, good.....2 4               |         |     |
| Slate .....0 4                   |         |     |
| Coal .....0 6                    |         |     |
| Concealed to river.....          | 8       | 0   |

(Elevation of coal, 980' A. T., Aneroid).

On the south side of the river at the falls the Upper Mercer coal has been mined in an abandoned railroad cut, the character of which may be seen by reference to the Valley Falls section on a previous page of this chapter. At that point Reger collected a sample from No. 14 of section and another from No. 16, the composition of which as reported by Messrs. Hite and Krak is given under No. 101 (Lab. Nos. 606-H and 607-H, respectively) in the table of coal analyses.

The foregoing sections show a considerable amount of Upper Mercer coal easily available for use at Valley Falls. The value of the coal, however, is seriously decreased by the fact, previously mentioned, that the Hammond fire clay often replaces it almost completely, a condition that interferes greatly with its value as a mining proposition.

#### **The Lower Mercer Limestone.**

The Lower Mercer limestone, which appears in the Pottsville series a short distance below the Upper Mercer coal, was noted at only a few points along the Tygart Valley river. Its place in the measures is shown by the geologic section for Powell. It is usually ferriferous and hard and seldom reaches 1 foot in thickness. According to I. C. White<sup>1</sup>, this limestone carries abundant evidence of fossil life in western Pennsylvania and southern Ohio, but no trace of fossils was found in the Tygart Valley region.

#### **The Lower Mercer Coal.**

The Lower Mercer coal, which occurs beneath the Lower Mercer limestone, is too thin and irregular to be of commercial or stratigraphic importance. Its position in the Pottsville series is shown by the geological section for Morgans Run and Powell, where it probably reaches its maximum development. In most of the regions where its horizon is above drainage, it was not found.

A section made along the Tygart Valley river, one-third mile below Hammond, shows the following:

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1. Bulletin 65, U. S. G. Survey, page 200.



**PLATE XXIII(a).**—Upper Connoquenessing Sandstone, capping Mitchell Knob at the northeast corner of Monongalia County.



**PLATE XXIII(b).**—Upper Connoquenessing sandstone showing cross-bedding at Cooner Rock, Monongalia County.





|   | Ft.     | In. |
|---|---------|-----|
| Shale, sandy, dark.....                                     | 10      | 0   |
| Limestone, dark, ferriferous, hard, Lower Mer-<br>cer ..... | 2" to 0 | 6   |
| Shale, gray.....  | 1       | 0   |
| Slate, black.....   | 2' to 2 | 6   |
| Coal, Lower Mercer.....                                     | 0       | 2   |
| Fire clay, flint.....                                       | 4       | 0   |
| (Elevation of Lower Mercer coal, 940' A. T., Aneroid).      |         |     |

This section shows not only the Lower Mercer limestone and the Lower Mercer coal, but also a flint fire clay that is below the horizon of the Mt. Savage or Hammond. The presence of fire clay is a feature that is a characteristic accompaniment of many exposures of the Mercer group of coals.

### The Upper Connoquenessing Sandstone.

The Upper Connoquenessing sandstone, which was first studied, named and described by I. C. White in Lawrence county, Pennsylvania, is the most persistent and characteristic stratum of the entire Pottsville series in the territory of this report and is largely responsible for the rough topography that is invariably found where the series is above drainage. It is usually light gray in color, very hard and resistant to weather, quite often has large angular quartz pebbles scattered throughout its mass, and abounds in the plant fossils of the coal measures, lepidodendra and sigillariae being the most noticeable. It usually forms a bold cliff along the hillsides and the talus from it litters the slopes and watercourses below. This sandstone crops across Monongalia county from the Pennsylvania line to Deckers creek, appears in the hills of eastern Marion county and goes below drainage for the last time at Valley Falls on the Taylor county line. At the government triangulation point on Mitchell Knob near the common corner to Monongalia, Preston and Fayette counties, it forms the top of the mountain close to the axis of the Chestnut Ridge anticline where its thickness is nearly 100 feet and its top is 2600 feet, aneroid, above sea level. At Valley Falls, 23 miles to the south, and also near the axis of the anticline, the top of the sandstone is only 975 feet, the dip of the axis being

70 feet to the mile. Its stratigraphic position and thickness may be seen by reference to the geological sections in chapter IV for Morgans Run, Mont Chateau, Quarry Run, Cheat View, Beaverhole, Rohr, Morgantown, Sturgis, Glover Gap, Whetstone Run, Downs, Montana Mines, Powell, and Stonehouse.

In eastern **Monongalia county** the Upper Connoquenessing sandstone forms the mountain tops from the Pennsylvania state line southward along the Preston county line to Cheat river. On Cheat river it rises above drainage just below Mont Chateau and from this point it rises rapidly southeast to the Chestnut Ridge anticline and remains high in the hills all the way to the Preston county line. It is this great sandstone that forms both Cooper Rock, north of the river, and Cheat View, south of the river, twin sentinels of stone that, together with the cliffs of which they are a part, have ever been the delight of the tourist.

The Upper Connoquenessing sandstone forms another picturesque gorge on Deckers creek. It rises from the creek a short distance east of Dellslow where it may be seen on either side of the creek, separated from the Homewood sandstone above it by only about 20 feet of a scarcely perceptible shale parting. As the stratum rises to the southeast toward the Chestnut Ridge anticline, it splits into two members, both of which are easily visible from the Morgantown and Kingwood railroad. The lower cliff, which is the Lower Connoquenessing sandstone, will be described later. The Upper Connoquenessing is quarried for glass sand by the Deckers Creek Stone & Sand Company at Sturgis, where it is 65 feet thick. Its character at that place will be described in detail in Chapter XIII. The stratum remains above drainage on Deckers creek all the way to the Preston line.

In **Marion county** the Upper Connoquenessing sandstone crops along Prickett creek, at the Winfield-Union district line, from Samaria to Dunham Lick run. At the Vincent Heirs gas well (683), which starts 10 feet above the sandstone, it is 54 feet thick.

On Tygart Valley this sandstone crops in the river just



PLATE XXIV.—Upper Connoquenessing Sandstone at Valley Falls, on the Tygart Valley River. Topography of the Allegheny and Pottsville Series in background.



below Hammond, rises rapidly southeastward to the axis of the Chestnut Ridge anticline, and passes under drainage at Valley Falls which it forms. The river between these two points is thickly strewn with boulders that have fallen from the cliff.

### **The Quakertown Coal.**

Below the Upper Connoquenessing sandstone a coal that was named the **Quakertown** by I. C. White is sometimes found. It is inconspicuous in the territory of this report and not important. It is noted in the geologic sections for Quarry run and Stonehouse. In the Vincent Heirs gas well (683), in Winfield district, Marion county, it is reported 7 feet thick at a depth of 64 feet.

### **The Lower Connoquenessing Sandstone.**

The Lower Connoquenessing sandstone, which underlies the Quakertown coal from which it is separated by a short interval of shale, is not generally present in the territory of this report. It is similar in character to the Upper Connoquenessing, though it is not usually so thick and does not make such a marked feature of the topography. It is light gray in color, massive and hard, and often contains quartz pebbles.

The Lower Connoquenessing sandstone crops only in Monongalia county from the Pennsylvania state line southward to Deckers creek beyond which to the southwest it passes completely under drainage. Its stratigraphic position and thickness may be studied in the geologic sections for Morgans Run, Quarry Run, Downs and Montana Mines. This sandstone may be seen at a few points along Cheat river. At Quarry run it is 10 feet thick, resting directly on the Mauch Chunk red shales.

The principal crop of Lower Connoquenessing sandstone noted was along the gorge of Deckers creek, where it is well developed. As stated previously, it separates from the Upper Connoquenessing about one-half mile east of Dellslow and

remains a distinct horizon until it goes under drainage in Preston county a short distance west of Cascade.

### **The Sharon Coal.**

The Sharon coal, which in western Pennsylvania lies just beneath the Lower Connoquenessing sandstone, was not noted above drainage at any point and not appearing in any of the geologic sections, may therefore be considered as absent from the Pottsville series of this district.

### **The Sharon Conglomerate.**

The Sharon Conglomerate, which in western Pennsylvania is the lowest member of the Pottsville series, is not often found in the territory of this report. It appears in the geologic sections for Morgans Run, Beaverhole, Sturgisson, Lick Run, and Stonehouse and may possibly be present in scattered oil well records west of its outcrop. It may be seen at Sturgisson well up the south hillside, along the incline of the Deckers Creek Stone & Sand Company, where it is the first sandstone visible when ascending the hill. Here it is 40 feet thick, massive, gray and pebbly, and is underlaid with a streak of coal about one-eighth of an inch thick.

At Lick Run the Sharon Conglomerate is high in the south hill, 15 feet thick, flaggy and gray, and lies 35 feet above the first visible red shales of the Mauch Chunk series.

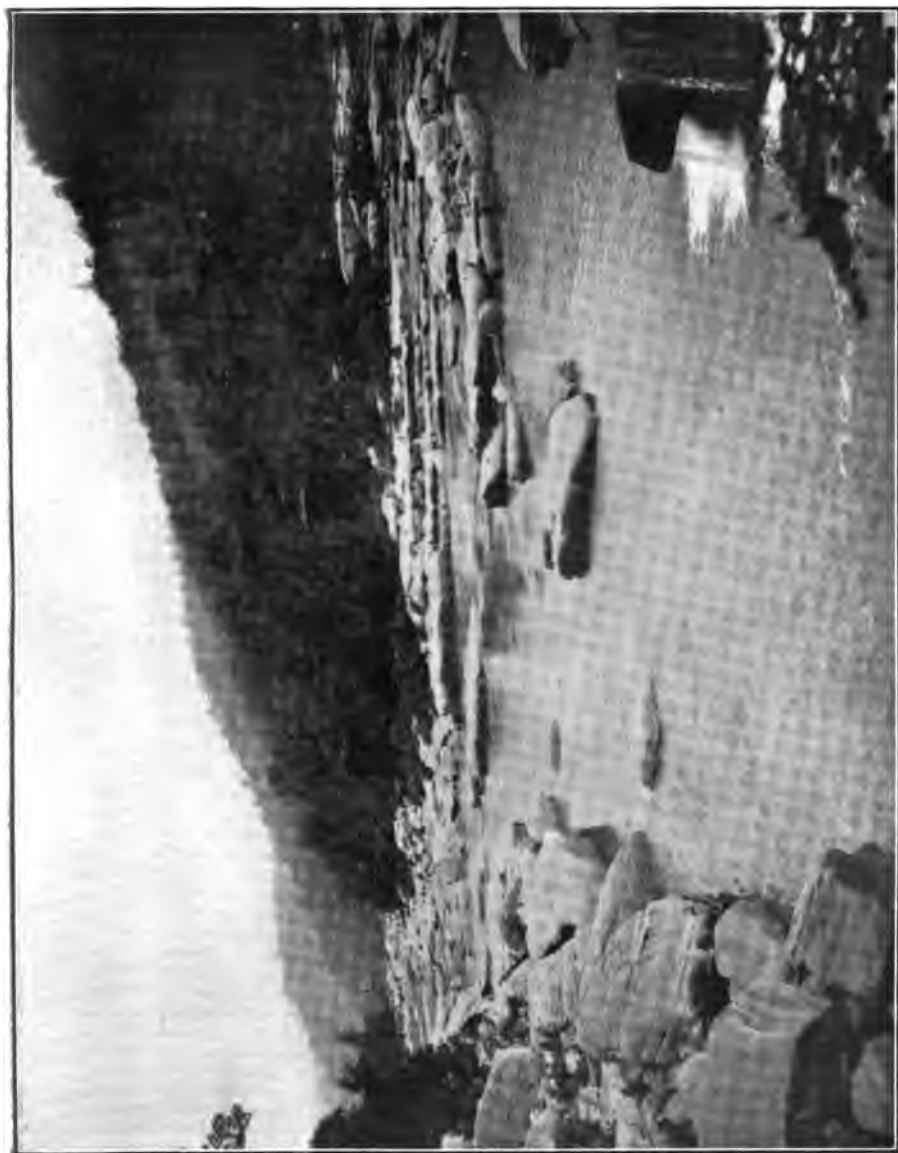


PLATE XXV.—Topography of the Allegheny and Pottsville Series and debris from the Pottsville in the Tygart Valley River below Valley Falls.





# CHAPTER X.

## STRATIGRAPHY—MISSISSIPPIAN ROCKS.

The Pottsville series, described in the preceding chapter, is the last one that contains coal in the territory of this report. The three following series; viz., the Mauch Chunk, Greenbrier, and Pocono, are usually classed as the Mississippian, Lower or Sub-carboniferous rocks because the Pocono series in some parts of the Appalachian region contains coal.

### *The Mauch Chunk Series.*

The Mauch Chunk series, which directly underlies the Pottsville, and which was named from the city of Mauch Chunk in eastern Pennsylvania, marks a complete lithologic change from the rocks above it. Neither the Allegheny nor the Pottsville series contains any reds, but red shale is the predominant feature of the Mauch Chunk. Since red beds are the result of oxidation, and oxidation of sediments usually takes place under atmospheric rather than aqueous agencies, the conclusion is apparent that the shales of the Mauch Chunk series, no matter what may have been their original color or condition, must have been exposed for ages to the action of the Paleozoic air.

The series crops in Monogalia county, mainly in the Cheat river canyon and the Deckers creek gorge, though there are a few isolated exposures farther north. Its crop is indicated on Map II. North of Cheat river these rocks may be seen near to the Pennsylvania line at the head of Ryan Hollow. They crop also on the head of Morgan run, Darnell Hollow, Johnson Hollow, and at several points on Quarry run. On Cheat river the Mauch Chunk rocks appear first at the mouth of Quarry run, and crop continuously on both sides of the river all the way to the Preston county line, four miles to

the southeast. In this region they are about 300 feet thick. On Deckers creek they crop continuously, from a point one-half mile east of Dellslow, for  $3\frac{1}{2}$  miles along the gorge all the way to the Preston county line. South of the Deckers creek gorge they do not crop in the territory of this report.

The stratigraphic position and thickness of the Mauch Chunk series may be studied in detail by reference to the geologic sections for St. Cloud, Cassville, Morgan Run, Quarry Run, Cheat View, Beaverhole, Rohr, Sturgisson, Glover Gap, Whetstone Run, Downs, Montana Mines and Stonehouse.

Reference to these sections will show that the Mauch Chunk series is only 123 feet thick at Glover Gap in western Marion and that it gradually increases in thickness to the southeast until at Sturgisson, in eastern Monongalia, it reaches 405 feet, the maximum thickness in the three counties.

As stated previously, the Mauch Chunk series is composed mainly of red shales. Quite frequently streaks of gray and brown shale appear and at an exposure on the Morgantown & Kingwood Railroad,  $\frac{3}{4}$  mile southeast of Sturgisson, there is a considerable deposit of pale green shale. Near the same point there is a ledge of green flaggy, micaceous, fine-grained sandstone which is a typical feature of the Mauch Chunk series as it often contains streaks of sandstone that invariably correspond to this description. In the territory of this report the sandstones are not prominent. There is seldom more than one and it is lenticular in character, often changing to shale in a very short distance. The Maxton oil sand is a member of the Mauch Chunk series. A limy shale or shaly limestone, which is usually crowded with marine fossils, is often found in the lower half of the Mauch Chunk. The record of plant life is indistinct, having evidently been largely destroyed by the same oxidizing agency that affected the shales.

### *The Greenbrier Limestone.*

The Greenbrier Limestone, named from its outcrop on the Greenbrier river in Greenbrier county, West Virginia, is the next formation below the Mauch Chunk shales. It was



PLATE XXVI.—Quarry in the Greenbrier Limestone at Sturgis, Morongalia County. The Mauch Chunk Shales are visible above the limestone.



formerly known as the "Mountain Limestone" and among the oil well drillers in the western part of the State it is invariably recorded as the "Big Lime". In the territory of this report it has a thickness of from 80 to 150 feet. It is a hard calcareous stratum, some portions of which are nearly pure calcium carbonate. At the top it often contains streaks of red shale making it hard to distinguish the line of separation from the Mauch Chunk series above. Occasional sandy streaks appear in the lower portion and in some places it changes gradually to the sandy rocks of the Pocono series below, the conclusion being that it rests conformably upon the Pocono rocks. The calcareous portions are usually full of marine fossils in an excellent state of preservation, the more common forms being crinoids, pelecypods and brachiopods. The color of the limestone is usually dark gray, both on fresh fracture and when exposed to the weather.

The stratigraphic position and thickness of this stratum may be seen by referring to the geologic sections for St. Cloud, Cassville, Morgan Run, Quarry Run, Cheat View, Beaverhole, Rohr, Sturgisson, Glover Gap, Whetstone Run, Downs, Montana Mines and Stonehouse. It is also named in numerous oil well records that will be published in a subsequent chapter.

The Greenbrier limestone crops only in **Monongalia county** in the region between the Pennsylvania line and Deckers creek. By referring to Map II it will be seen that it crops in the head of Ryan Hollow, Morgan run and Darnell Hollow. In Darnell Hollow there is a small quarry operated for agricultural lime on the land of Wm. F. Darnell, where the following section was exposed:

|                                 | Feet. |
|---------------------------------|-------|
| 1. Concealed .....              | ..    |
| 2. Reds .....                   | 5     |
| 3. Limestone, silicious.....    | 2     |
| 4. Limestone, bluish gray ..... | 5     |
| 5. Concealed .....              | ..    |

A sample collected here from No. 4 and reported by Messrs. Hite and Krak under Lab. No. 639-H gave the following analysis:

|  | Per cent.    |
|--|--------------|
| Silicic acid (Si O <sub>2</sub> ) .....                | 5.65         |
| Ferric Iron (Fe <sub>2</sub> O <sub>3</sub> ) .....    | 0.86         |
| Alumina (Al <sub>2</sub> O <sub>3</sub> ) .....        | 1.44         |
| Calcium Carbonate (Ca CO <sub>3</sub> ) .....          | 85.34        |
| Magnesium Carbonate (Mg CO <sub>3</sub> ) .....        | 1.38         |
| Phosphoric Acid (P <sub>2</sub> O <sub>5</sub> ) ..... | 0.20         |
| Loss on ignition .....                                 | 4.86         |
| <b>Total</b> .....                                     | <b>99.73</b> |

On Cheat river the Greenbrier limestone appears above drainage one mile southeast of Mont Chateau and is exposed along the river all the way to the Preston county line, 3½ miles to the southeast. On Scott run at the county line, Reger measured the following section:

|   | Feet. |
|---|-------|
| Limestone, fossiliferous, making cliff .....                        | 70    |
| Sandstone, brown, soft, pebbly .....                                | 15    |
| Limestone, hard .....   | 10    |
| Concealed, mostly sandstone, Pocono.....                            | 105   |
| Sandstone, hard gray, medium grained,<br>making falls, Pocono ..... | 60    |

On Deckers creek the Greenbrier limestone rises above drainage one mile north of Sturgisson and is exposed on both sides of the gorge until it passes beneath the creek level, 2½ miles to the southeast, ¼ mile west of the Preston county line. It is quarried at Sturgisson by the Deckers Creek Stone & Sand Company for ballast and concrete. Here it is fairly pure and the fossil marine life is abundant.

At Lick Run station boulders of this limestone are exposed and an attempt was made to open a quarry, but owing to the large amount of surface drift encountered, the project was abandoned.

The economic aspects and uses of the Greenbrier limestone will be discussed fully in a subsequent chapter.

### *The Pocono Series.*

The Pocono series, which immediately underlies the Greenbrier limestone, and which was named from the Pocono mountains in northeastern Pennsylvania, is the lowest group

of rocks exposed in the territory of this report. As shown principally by oil well records, it has a thickness of about 500 feet, there being little variation from this figure.

The Pocono series consists of alternating beds of gray sandstones, sometimes pebbly, and gray or brown shales, with a few streaks of iron ore. In the upper portion there is often a calcareous member, making it hard to distinguish the line of division between the Pocono and the Greenbrier limestone above. No fossils were found in the series, but S. B. Brown, Professor of Geology at the West Virginia University, reports marine fossils at Beaverhole in Preston county near the Monongalia line.

The Pocono series has been of enormous economic importance in this territory, owing to the fact that it contains four oil sands; viz., the Keener, Big Injun, Squaw and Berea. Of these the Big Injun is the one most developed. West of the Monongahela river in Monongalia and Marion counties, it has produced oil and gas in greater quantity than any other sand.

The stratigraphic position and thickness of the Pocono series is given in the geologic sections for St. Cloud, Cassville, Morgan Run, Quarry Run, Cheat View, Beaverhole, Rohr, Glover Gap, Whetstone Run, Downs, Montana Mines, and Stonehouse. It is also given in numerous oil well records published in this report.

The Pocono series crops only in Monongalia county between the Pennsylvania line and Deckers creek. There should be a small area of these rocks exposed in the head of Ryan Hollow. On Cheat river, as shown on Map II, the Pocono rocks crop for three miles along the canyon next to the Preston county line.

On Scott run at the Preston line, Reger measured the following section of the Pocono series:

|  | Thickness. | Total. |
|--|------------|--------|
|  | Feet.      | Feet.  |
| Limestone, Greenbrier.....                             |            |        |
| Concealed, mostly sandstone.....                       | 105        | 105    |
| Sandstone, hard, gray, medium grain, making falls..... | 60         | 165    |
| Slate, gray, with streaks of red.....                  | 20         | 185    |
| Shale, red .....                                       | 20         | 205    |



|   |    |     |
|---|----|-----|
| Sandstone, shaly.....                                       | 15 | 220 |
| Shale, gray, with nodules of low grade iron carbonate ..... | 50 | 270 |
| Concealed .....   | 85 | 355 |
| Sandstone, hard, brown, making cliff.....                   | 20 | 375 |
| Concealed to Cheat river at Beaverhole.....                 | 55 | 430 |

Owing to the dip of the rocks the thicknesses are only approximate. The iron ore noted in the section appears also in the section made by Reger on the opposite side of Cheat river, two miles north of Rohr.

On Deckers creek the Pocono series is exposed at Iron Bridge where the Chestnut Ridge anticline crosses Deckers creek. The outcrop extends for more than a mile along the creek, the maximum thickness above drainage being only 30 to 40 feet. The sandstone there is pebbly, hard, and white with streaks of green.

# PART III.

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## Mineral Resources.

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### CHAPTER XI.

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#### PETROLEUM AND NATURAL GAS.

As mentioned in other county reports, all the oil and gas yet discovered in West Virginia, with one or two exceptions, has been produced from sandstone beds, designated "sands" by well drillers. The Greenbrier limestone, or "Big Lime", has produced some dark, heavy oil in northern Calhoun and northeastern Roane counties, being the only calcareous stratum that has produced either oil or gas in the State. The following table, from page 271 of the Doddridge-Harrison Report of the State Survey, exhibits in descending order the position of the sands, or the oil and gas bearing horizons in West Virginia:

### The Oil and Gas Horizons of West Virginia.

|                |                              |  |
|----------------|------------------------------|--|
| Carboniferous. | Monongahela Series           | Carroll sand (Uniontown.<br>Minshall (Connellsville).<br>Murphy (Morgantown).  |
|                | Conemaugh Series             | Moundsville (Saltsburg).<br>First Cow Run (Little Dunkard) sand<br>(Buffalo).<br>Big Dunkard sand (Mahoning).  |
|                | Allegheny Series             | Burning Springs (Upper Freeport)<br>sand.<br>Gas sand (Lower Freeport).  |
|                | Pottsville Series            | Gas sand of Marion and Monongalia<br>counties (Homewood), Second Cow<br>Run of Ohio.<br>Gas sand of Cairo.<br>Salt sand of Cairo.<br>Cairo?  |
|                | Mauch Chunk Red Shale        | Maxton, Dawson, Cairo.   |
|                | Grenbrier Limestone.         | "Big Lime"; not generally productive.  |
|                | Pocono Sandstones            | Keener sand and Beckett sand of<br>Milton.<br>Big Injun sand.<br>Squaw sand.<br>Berea Grit.  |
| Devonian.      | Catskill Red Beds            | Gantz sand.<br>Fifty-foot sand.<br>Thirty-foot sand.<br>Stray sand<br>Gordon sand.<br>Fourth sand.<br>McDonald or Fifth sand.<br>Payard or Sixth sand.<br>Elizabeth or Seventh sand. |
|                | Chemung and Portage<br>Beds. | Warren First or Second Tiona.<br>Speechley sand. No well defined oil<br>or gas horizons yet discovered<br>in West Virginia.  |

Oil and gas have been found in the area under discussion in the Moundsville (Saltsburg) sand just below the middle of the Conemaugh series down through the rock column to and including the Bayard or Sixth sand near the base of the Catskill measures. The Chemung and Portage rocks have been penetrated by two or three deep wells, but no producing

horizons have yet been encountered therein by the drill. The table below gives not only the sequence of the sands that have produced either oil or gas in the area, but the approximate interval of each in feet below the Pittsburgh coal—a widely used “key rock” by the drillers in these counties:

**Approximate Interval from Pittsburgh Coal to Top of Oil and Gas Sands.**

| SANDS                                   | In'r'l<br>Feet | SANDS                     | In'r'l<br>Feet |
|---|----------------|---------------------------|----------------|
| Murphy (Morgantown).....                | 210            | Squaw .....               | 1575           |
| Moundsville (Saltsburg)...              | 350            | Berea Grit .....          | 1850           |
| First Cow Run (Little<br>Dunkard) ..... | 420            | Gantz .....               | 1925           |
| Big Dunkard (Mahonings) ..              | 500            | Fifty-foot .....          | 1975           |
| Gas sand (Lower Freeport) ..            | 600            | Thirty-foot .....         | 2025           |
| Second Cow Run<br>(Homewood) .....      | 825            | Stray .....               | 2080           |
| Salt (Connoquenessings)...              | 900            | Gordon .....              | 2150           |
| Maxton .....                            | 1125           | Fourth .....              | 2225           |
| Keener .....                            | 1350           | Fifth or McDonald .....   | 2300           |
| Big Injun .....                         | 1375           | Sixth or Bayard .....     | 2430           |
|   |                | Seventh or Elizabeth .... | 2550           |

All the Carboniferous rocks have a tendency to thicken southeastward; hence, it is readily observed that no specific figures can be given for intervals below any key rock that will hold good over the entire area.

**DESCRIPTION OF SANDS.**

**Conemaugh Series.**

**Murphy Sand.**—This sand, correlating with the Morgantown sandstone of the Conemaugh series, ranges from 20 to 50 feet thick and belongs 175 to 200 feet below the Pittsburgh coal. It has produced oil near Moundsville, Marshall county, and Deems Ferry, Wirt county. In the area under discussion no oil in paying quantity has been produced from this horizon, but a small flow of gas has been encountered therein in a few wells, among which is the P. W. Yost No. 1 well (560), located 0.3 mile west of Fairview.

**Moundville Sand.**—This sand, correlating with the Saltsburg sandstone of the Conemaugh series and belonging 325 to 360 feet below the Pittsburgh coal, has been so named from Moundville<sup>1</sup>, Marshall county, where it has produced considerable oil. So far as known to the writer it has proved productive at only one point in the area under discussion; viz., in the A. H. Heldreth No. 1 well (478), located 0.5 mile northwest of Margaret, Marion county, where a flow of gas was encountered by the Delmar Oil Company in a sand, 28 feet thick, the top of which comes 330 feet below the top of the Pittsburgh coal. There the driller wrongly correlated the horizon with the Little Dunkard sand.

**I Cow Run (Little Dunkard) Sand.**—At about 425 feet below the Pittsburgh coal there belongs an oil and gas producing stratum that has been designated by the drillers as the First Cow Run sand in Washington county, Ohio, and later, the Little Dunkard, in southeastern Greene county. This horizon correlates with the Buffalo sandstone of the Conemaugh series and not the Saltsburg as has been worked out in detail by the writer on pages 281-285 of the Wirt-Roane-Calhoun Rept. of the State Survey.

This sand is at present producing gas from three wells in the town of Westover, Monongalia county, which were drilled for water but proved to be gaseous. Each has sufficient pressure to provide domestic fuel for a household. There are two pays in the sand, the upper one being found about 100 feet underground and the lower one about 140 feet.

**Big Dunkard Sand.**—This sand, belonging about 500 feet below the Pittsburgh coal and correlating with the Mahoning sandstones of the Conemaugh series, was so named by the drillers in the early days of the petroleum industry from Dunkard creek, in southeastern Greene county, Pa., where much oil was produced from this horizon. The reader is referred to pages 285-286 of the Wirt-Roane-Calhoun Report of the State Survey for correlation details. The Alpheus Morris No. 2 well (306), located in Grant district, Monongalia,

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1. Ray V. Hennen, Doddridge-Harrison Rept., W. Va. Geol. Sur., p. 273; 1912.

1.6 miles northeast of Hagans, reports two gas pays in this sand the top of which comes 518 feet below the top of the Pittsburgh coal. This is the only well noted in which oil or gas was recorded.

### *The Allegheny Series.*

The **Burning Springs<sup>2</sup> (Upper Freeport)** sand is non-productive in the area.

**Gas Sand.**—The term "Gas sand" has been applied to a gaseous stratum in Monongalia and Marion counties, belonging 600 to 650 feet below the Pittsburgh coal. It correlates with the Lower Freeport sandstone of the Allegheny series and ranges in thickness from 50 to 100 feet. The Iona Bowlby No. 1 well (255) in Cass district, Monongalia county, located 0.6 mile southwest of Bowlby, produces gas from this horizon (See log). A seven-barrel daily flow of oil was encountered in this sand in the P. W. Yost No. 1 well (560), located in Pawpaw district, Marion, 0.4 mile west of Fairview, where the stratum is 61 feet thick, 648 feet below the Pittsburgh coal. At the end of 12 days, however, it was not making  $\frac{1}{2}$  barrel. No paying wells have been encountered at this horizon in the area.

### *The Pottsville Series.*

**II Cow Run Sand.**—This sand, belonging at the top of the Pottsville series, 825 to 850 feet below the Pittsburgh coal, and correlating with the Homewood sandstone, has produced a large amount of oil both in Ohio and West Virginia. Its true correlation has been worked out in detail by the writer in its type locality at Cow Run, Washington county, Ohio, and published on pages 287-290 and 281-285 of the Wirt-Roane-Calhoun Report of the State Survey. It is frequently mistaken for the Salt sand, 25 to 50 feet lower in the measures, and many of the oil and gas shows reported by drillers in the latter horizon probably belong in the II Cow Run.

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2. Ray V. Hennen, Wirt-Roane-Calhoun Rept., W. Va. Geol. Survey, pp. 286-287; 1911.

**Salt Sands.**—The original Salt sand of the drillers correlated with the Upper Connoquenessing sandstone of the Pottsville series, but later the several sandstone ledges of these measures were called First, Second and Third Salt. They constitute the middle and basal portion of the latter series, and have produced a large amount of both oil and gas in the State.

In **Monongalia** a light show of oil is reported at this horizon in Union district, at the Francis Costolo No. 1 well (327), located at the mouth of Rubles run on the east bank of Cheat river.

In **Marion** a flow of gas was encountered in two different wells according to the logs furnished by the owners; viz., Joseph Hayhurst No. 1 (374), located 2 miles east of Brink, and M. S. Snodderly No. 1 (543), located on the head of Fleming fork, 2 miles southwest of Mannington.

Just across the **Taylor county** line in Preston a show of both oil and gas is reported in the Idell Debillier No. 1 well (720), located 0.5 mile southeast of Irondale.

No paying wells from these sands are reported in any of the three counties.

### *The Mauch Chunk Series.*

**Maxton Sand.**—This sand, belonging near the base of the Mauch Chunk series about 1125 feet below the Pittsburgh coal, and ranging from 10 to 80 feet in thickness, has produced considerable oil and gas in Tyler, Wetzel, Roane and Calhoun counties. In the area under discussion it has not attained much economic importance in either Monongalia or Taylor, but in Marion it has produced both oil and gas in the southwest portion of Mannington district.

### *The Pocono Series.*

**Big Injun Sand.**—This sand, belonging immediately under the "Big Lime" or Greenbrier limestone, 1300 to 1400 feet below the Pittsburgh coal and frequently attaining a thickness of 300 feet, is one of the most prolific oil and gas

horizons not only in the State, but in the area under discussion. A glance at the table of wells for each county on subsequent pages of this report will readily show the depth to the top of the sand as well as the localities where it has proved productive. The Big Injun is a hard, fine-grained sandstone with usually two and sometimes three or four open, coarse and pebbly layers, filled with gas, oil or salt water, and called "pay" streaks by the drillers. In Monongalia and Marion counties it is often 140 to 150 feet thick without a break of slate, with a gas pay 15 to 25 feet from the top; the first oil pay, 60 to 75 feet from the top; and a second or big pay at 80 to 90 feet in the sand. Frequently a third pay occurs at about 110 feet from the top.

Along the western border of the State, thirty to forty feet of the top portion of this stratum is often separated from the main bed by 5 to 15 feet of dark slate, as happens at the southwest edge of the Sistersville oil field of Tyler county, where this top portion is known as the **Keener sand**.

Sometimes the bottom portion of the Big Injun is separated from the main bed by a layer of slate, 15 to 25 feet thick, this basal part then being designated the **Squaw sand**.

**The Berea Grit.**—The Berea Grit formation, belonging about 1850 feet below the Pittsburgh coal and at the base of the Pocono sandstone group, has produced a large amount of oil and gas in Pleasants, Wood, Ritchie, Lewis, Gilmer, Calhoun, Roane, Kanawha and Lincoln counties. In the area under discussion, although noted in many of the well records, it has generally proved non-productive.

### *Devonian—Catskill Series.*

In the Catskill series of the Devonian rocks, eight different sands have produced either oil or gas in the three counties; viz., Gantz, Fifty-foot, Thirty-foot, Stray, Gordon, Fourth, Fifth or McDonald, and Sixth or Bayard.

**Gantz Sand.**—The Gantz sand, belonging near the top of the Catskill, about 1925 feet below the Pittsburgh coal and ranging from 20 to 40 feet thick, is the next oil and gas horizon below the Berea Grit, having been so named from a well



on the Gantz<sup>3</sup> farm at Washington, Pa., where it comes 1827 feet below the Pittsburgh coal. It appears to be the top portion of the Hundred-foot sand of Butler county, Pa. In the area under discussion no paying oil wells are reported at this horizon, but several good gas flows have been encountered. The table of wells for each county shows the regions in which it has proved productive.

**Fifty-foot Sand.**—This sand closely underlies the last formation described and appears to be the basal portion of the Hundred-foot sand of Butler county, Pa. It belongs about 1975 feet below the Pittsburgh coal, and in Monongalia and Marion counties it has produced gas at a few widely scattered wells. In Taylor two heavy gassers were encountered at this horizon in the J. F. Holt No. 1 well (690), located 0.7 mile southeast of Boothsville, and the U. S. Morrow No. 1 well (707), 1 mile east of Meadland.

**Thirty-foot Sand.**—The next oil and gas horizon below that last described is what is known as the Thirty-foot, being 20 to 40 feet in thickness and belonging about 2025 feet below the Pittsburgh coal. A large amount of oil has been produced from this horizon in western Marion county in the fields immediately northwest of Glover Gap and northeast of Rymer. This sand has generally proved non-productive in Monongalia and Taylor. The table of wells for each county shows its depth and the districts in which it has proved productive.

**Gordon Stray Sand.**—This sand appears to be a split off the true Gordon next below and belongs 5 to 40 feet above the latter and a few feet below the red shale separating it from the Thirty-foot above. It ranges in thickness from 10 to 40 feet and comes 1075 to 2100 feet below the Pittsburgh coal. Shows of oil and gas have been encountered at this horizon at several widely scattered wells in the three counties.

**Gordon Sand.**—This sand, belonging about 2150 feet below the Pittsburgh coal and ranging in thickness from 20 to 40 feet, is one of the most prolific oil and gas horizons in

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3. Stone & Clapp, Bull. 304, U. S. Geol. Sur., pp. 35-36; 1907.

Pennsylvania and West Virginia, and likewise within the three counties under discussion. As with all the sands in the middle and basal portions of the Catskill series it is difficult of correlation and the name "Gordon" is applied indiscriminately by drillers to the Stray, Gordon and Fourth. The table of well records for each county exhibits not only its depth, but the districts in which it is productive. The Campbells Run and Whetstone Run sands both belong at this horizon.

**Fourth Sand.**—The next oil and gas horizon below that last described is the Fourth sand, 50 to 75 feet lower in the measures and about 2225 feet below the Pittsburgh coal. It is also a very prolific oil and gas horizon in the State and especially in Monongalia and Marion counties. A belt of oil wells—1 to 2 miles wide—in this sand extends entirely across Monongalia from near Shamrock on Dunkard creek southwestward to the Monongalia-Marion county line due south of St. Leo. Another belt of wells in this sand occurs in the southeast corner of Clay district. It is also a great oil horizon on the waters of Flat run in Marion county. No wells are reported from this sand in Taylor. The table of wells for each county shows the localities where it is productive, as well as its depth.

**Fifth or McDonald Sand.**—The Fifth or McDonald sand, 20 to 50 feet thick and about 2300 feet below the Pittsburgh coal, is the next oil and gas horizon below that last described. The drillers of Monongalia and Marion counties have erroneously designated an oil bearing sand in the Fairview field as the Fifth, but the data given on pages 141-142 of Vol. 1(A) of the State Survey reports, show the latter to be 100 feet higher in the measures, and the oil horizon to be the Bayard. The Fifth sand is an important gas horizon in each of the three counties, and the table of well records exhibits not only its depth, but the localities where it is productive.

**Sixth or Bayard Sand.**—This sand, belonging 2410 to 2425 feet below the Pittsburgh coal, is the deepest producing oil and gas horizon in the three counties. As mentioned above under the description of the Fifth sand, it is an important oil horizon in the Fairview field, coming there 100 feet below the

Fifth and 2410 feet below the Pittsburgh coal. The table of well records for each county exhibits its depth and the districts in which it is productive.

## OIL AND GAS DEVELOPMENT.

### *Early History.*

The early history of the oil and gas development in this area began in October, 1889, with the completion of the Hamilton No. 1 well (541), located 0.6 mile southeast of Mannington, Marion county, in which a flow of oil was encountered in the Big Injun sand. This test well was a successful attempt by I. C. White in the practical application of the principles embodied in the anticlinal theory in the discovery of oil and gas pools, a complete account of which is given on pages 54-60 of Vol. I(A) of the State Survey reports. Soon thereafter the Mt. Morris pool of Greene county, Pa., was extended southwestward in an unbroken belt of wells to a point six miles beyond Mannington. Later pools to be developed were the Flat Run, Campbells Run, St. Leo. Cross Roads, Klondike, Bula, and other minor pools, all of which will be discussed more in detail on subsequent pages.

## MONONGALIA COUNTY WELL RECORDS.

As with similar reports prepared by the writer, the main source of information as to the thickness of the coals and other formations of economic interest where they lie deeply buried below drainage has been the logs or records of many wells bored for oil, gas and coal by both individuals and corporations, through the courtesy of whom the Survey has been enabled to collect a large number. Levels were taken on many of these wells while gathering data in the field. The records of the same are in most cases incomplete, in that generally only the Pittsburgh coal and the most important oil and gas sands are noted. The importance of keeping accurate logs of all strata penetrated is well set forth in the Preface to Vol. I(A) of the State Survey reports.



PLATE XXVII.—Topography of the Dunkard Series and oil wells near head of Smoky Drain, 2 miles northwest of Cassville, Monongalia County.

Photo by Ray Bricker.



The accompanying table contains the abbreviated records of about 250 wells in Monongalia county, as well as elevations on nearly 100 other wells the logs of which were not obtainable. The wells are numbered consecutively from 1 up to 344 and grouped largely by magisterial districts, the serial number in all cases corresponding to the number of the same well on Map II. Similar tables are given on subsequent pages for Marion and Taylor counties, and generally where one of these tabulated wells is mentioned in the text, the serial number is added therewith in parenthesis.

Under the column headed "Owner" in the Monongalia table, the following abbreviations are used:

|                        |   |
|------------------------|---|
| Alpha .....            | Alpha Oil Company.                            |
| Battelle .....         | Battelle Oil Company.                         |
| Carnahan .....         | Carnahan and Debendorfer.                     |
| Carnegie .....         | Carnegie Natural Gas Company.                 |
| Carter .....           | Carter Oil Company.                           |
| Chartiers .....        | Chartiers Oil Company.                        |
| Consolidation .....    | The Consolidation Coal Company.               |
| Daybrook .....         | Daybrook Oil Company.                         |
| Delmar .....           | Delmar Oil Company.                           |
| Fisher .....           | Fisher Oil Company.                           |
| Fort Pitt .....        | Fort Pitt Gas Company.                        |
| Globe .....            | Globe Fuel Company.                           |
| Home Gas .....         | Home Gas Company.                             |
| Hope .....             | Hope Natural Gas Company.                     |
| Hukill .....           | E. M. Hukill & Company.                       |
| Kuntz, Jr., & Co. .... | James Kuntz, Jr. & Company.                   |
| Mfrs. L. & H. ....     | Manufacturers Light & Heat<br>Company.        |
| McDermott .....        | Joseph H. McDermott.                          |
| Mississippi .....      | Mississippi Glass Company.                    |
| Mt. Park .....         | Mountain Park Land Company.                   |
| Phila. ....            | Philadelphia Company of West<br>Virginia.     |
| Pure .....             | Pure Oil Company.                             |
| Randall .....          | Randall Gas & Water Company.                  |
| Round Bottom .....     | Round Bottom Oil & Gas Company.               |
| South Penn .....       | South Penn Oil Company.                       |
| Spindletop .....       | Spindletop Company.                           |
| Syndicate .....        | Syndicate Oil & Gas Company.                  |
| Thompson .....         | Sterling and Thompson.                        |
| Tin Plate .....        | American Sheet & Tin Plate<br>Company.        |
| Wheeling .....         | Wheeling Natural Gas Company.                 |
| W. Va. T. & E. ....    | West Virginia Traction & Electric<br>Company. |

## Summarized Record of

| Map No. | NAME OF WELL                | Location—<br>District  | OWNER               | Elevation<br>A. T. |
|---------|-----------------------------|------------------------|---------------------|--------------------|
| 1       | John E. Snyder No. 1.....   | Battelle .....         | Cochran & Funk..... | 1425B              |
| 2       | B. Renner No. 1.....        | Springhill (Pa.) ..... | Meals et al. ....   | 1175B              |
| 3       | K. Renner Heirs No. 1.....  | Springhill (Pa.) ..... | Mfg. L. & H. ....   | 1115B              |
| 4       | S. L. S. Spragg No. 1.....  | Battelle .....         | Syndicate .....     | 1161L              |
| 5       | Ell White No. 1.....        | Battelle .....         | Gibson .....        | 1075B              |
| 6       | F. H. Hennen No. 1.....     | Battelle .....         | Carnegie .....      | 1110B              |
| 7       | Jas. L. White No. 1.....    | Battelle .....         | Phila .....         | 1240B              |
| 8       | John G. White No. 1.....    | Battelle .....         | Carnegie .....      | 1150B              |
| 9       | Simon L. White No. 1.....   | Battelle .....         | Phila .....         | 1130B              |
| 10      | Thos. White No. 1.....      | Battelle .....         | Mfg. L. & H. ....   | 1065B              |
| 11      | F. M. Staggers No. 1.....   | Gilmore (Pa.) .....    | .....               | 1130B              |
| 12      | J. P. Hagan No. 2.....      | Gilmore (Pa.) .....    | Phila .....         | 1095B              |
| 13      | J. P. Hagan No. 1.....      | Gilmore (Pa.) .....    | Phila .....         | 1040B              |
| 14      | Hagan Taylor No. 1.....     | Battelle .....         | Ferguson .....      | 1029L              |
| 15      | John W. White .....         | Battelle .....         | .....               | 1130B              |
| 16      | Wm. Porter No. 1.....       | Gilmore (Pa.) .....    | Carnegie .....      | 1165B              |
| 17      | Ed. Clovis No. 1.....       | Gilmore (Pa.) .....    | Ferguson .....      | .....              |
| 18      | Jacob Simpson No. 1.....    | Gilmore (Pa.) .....    | Hope .....          | 995B               |
| 19      | John Lantz No. 2562.....    | Gilmore (Pa.) .....    | Phila .....         | 990B               |
| 20      | T. W. Kinnan No. 1.....     | Battelle .....         | .....               | 1060B              |
| 21      | Eliza Wade No. 2348.....    | Battelle .....         | Phila .....         | 1020B              |
| 22      | L. A. Stiles No. 1.....     | Battelle .....         | Hope .....          | .....              |
| 23      | Minerva Hennen No. 1.....   | Battelle .....         | Hope .....          | 1050B              |
| 24      | Jas. Hagan No. 1.....       | Battelle .....         | Carnegie .....      | 990B               |
| 24A     | Solomon Russell No. 1.....  | Battelle .....         | Hope .....          | 1055B              |
| 25      | Sol Shriver No. 1.....      | Battelle .....         | Hope .....          | .....              |
| 26      | Mary A. Eakin No. 1.....    | Battelle .....         | Phila .....         | 1005B              |
| 27      | Sol Shriver No. 2.....      | Battelle .....         | Hope .....          | 1015B              |
| 28      | Sol Shriver No. 3.....      | Battelle .....         | Hope .....          | .....              |
| 29      | Geo. W. Shriver No. 1.....  | Battelle .....         | Phila .....         | 1095B              |
| 30      | Henry W. Haines No. 1.....  | Battelle .....         | .....               | .....              |
| 30A     | Jasper Shriver No. 1.....   | Battelle .....         | Phila .....         | .....              |
| 31      | Alonzo Edwards No. 1.....   | Battelle .....         | Battelle .....      | 1065B              |
| 32      | L. H. & R. Wilson No. 1.... | Battelle .....         | South Penn .....    | 1159L              |
| 33      | E. B. Bell No. 2239.....    | Battelle .....         | Phila .....         | .....              |
| 34      | R. S. Clovis No. 1.....     | Battelle .....         | Fort Pitt .....     | 1045B              |
| 35      | Elijah C. Clovis No. 1..... | Battelle .....         | Mfg. L. & H. ....   | 1165B              |
| 36      | Barney Renner No. 2288....  | Battelle .....         | Phila .....         | 1402L              |
| 37      | Barney Renner No. 2165....  | Battelle .....         | Phila .....         | 1365L              |
| 38      | Nancy Hostutler No. 1.....  | Battelle .....         | Mfg. L. & H. ....   | 1200B              |
| 39      | Amon Johnson No. 1.....     | Battelle .....         | Wheeling .....      | .....              |
| 40      | Nancy Johnson No. 1.....    | Battelle .....         | Mfg. L. & H. ....   | 1095B              |
| 41      | J. H. Six No. 1 .....       | Battelle .....         | Carnegie .....      | 1110L              |
| 42      | Barrickman-Goodnight No. 1. | Battelle .....         | .....               | 1145B              |
| 43      | Lewis Lemley No. 1.....     | Battelle .....         | Fisher .....        | .....              |
| 44      | Jackson Hostutler No. 1.... | Church (Wetzel) .....  | Fisher .....        | 1510B              |
| 44A     | Marlon Henderson No. 2411.. | Battelle .....         | Phila .....         | .....              |

Wells in Monongalia County

| PITTSBURGH COAL |           | Big Injan Sand (top) | Thirty Foot Sand (top) | Gordon Sand (top) | Fourth Sand (top) | Fifth Sand (top) | Total Depth | PRODUCING SAND AND REMARKS          | Map No. |
|-----------------|-----------|----------------------|------------------------|-------------------|-------------------|------------------|-------------|-------------------------------------|---------|
| Depth (top)     | Thickness |                      |                        |                   |                   |                  |             |                                     |         |
| 1200            | 9         | 2450                 | 2810                   | .....             | 3338              | .....            | 3390        | Big I. gas and 4th oil..            | 1       |
| 951             | 7         | 2204                 | 2893                   | 3027              | 3075              | 3173             | 3208        | Gord oil show.....                  | 2       |
| 901             | 7         | 2160                 | .....                  | 3060              | 3135              | .....            | .....       | Big I., 4th and Ellz....            | 3       |
| 929             | 6         | 2184                 | 2953                   | 3095              | 3155              | 3195             | 3406        | Big I., gas and 4th oil..           | 4       |
| 789             | 11        | 2087                 | .....                  | .....             | .....             | .....            | 2890        | Big I. and Gnz. gas....             | 5       |
| 855             | ..        | 2115                 | 2878                   | 2974              | 3025              | 3109             | 3211        | 50-ft., 30-ft. and Gord gas.        | 6       |
| 984             | 8         | 2282                 | .....                  | 3235              | 3276              | .....            | 3520        | Dry hole .....                      | 7       |
| 880             | 8         | 2181                 | .....                  | 3055              | 3150              | 3181             | 3308        | Big I. gas show .....               | 8       |
| 845             | ..        | 2131                 | .....                  | 3020              | 3080              | 3136             | 3163        | Fifth gas .....                     | 9       |
| 785             | 8         | 2050                 | .....                  | .....             | .....             | .....            | 2240        | Big I. gas .....                    | 10      |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | Big I. gas .....                    | 11      |
| 805             | 8         | 2090                 | 2852                   | 3005              | .....             | .....            | .....       | Big I. and 50-ft. gas shows         | 12      |
| 740             | 7         | 2021                 | .....                  | .....             | 2950              | 3058             | 3343        | Big I. and 5th gas....              | 13      |
| 725             | ..        | .....                | .....                  | .....             | .....             | .....            | .....       | 5th gas .....                       | 14      |
| 830             | ..        | .....                | .....                  | .....             | .....             | .....            | .....       | Non-paying gas .....                | 15      |
| 900             | ..        | 2200                 | .....                  | .....             | .....             | 3185             | 3520        | 6th gas show .....                  | 16      |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | 4th oil .....                       | 17      |
| 703             | 3         | 1965                 | .....                  | .....             | .....             | .....            | 2073        | Big I. gas .....                    | 18      |
| 710             | ..        | 1975                 | .....                  | .....             | .....             | .....            | 2003        | Big I. gas .....                    | 19      |
| 780             | 8         | 2059                 | .....                  | .....             | .....             | .....            | 2099½       | Big I. gas .....                    | 20      |
| 750             | ..        | 2033                 | .....                  | .....             | .....             | .....            | 2195        | Big I. gas .....                    | 21      |
| 800             | ..        | 2082                 | .....                  | .....             | 3027              | 3102             | 3280        | Big I. and 5th gas .....            | 22      |
| 748             | 5         | 2034                 | 2550                   | 2939              | 2995              | 3942             | 3075        | Big I., 4th and 5th gas.            | 23      |
| 717             | ..        | 2013                 | .....                  | .....             | 2923              | 2981             | 3264        | Gnz. gas light .....                | 24      |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | .....                               | 24A     |
| 1038            | ..        | 2305                 | .....                  | .....             | 3250              | 3337             | 3344        | Gordon gas .....                    | 25      |
| 780             | ..        | 2062                 | .....                  | .....             | 2995              | 3038             | 3161        | Gnz oil show .....                  | 26      |
| 781             | 8         | 2058                 | .....                  | .....             | 3012              | 3051             | 3075        | Big I. oil, 50-ft. and 4th gas      | 27      |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | .....                               | 28      |
| 772             | 9         | .....                | .....                  | .....             | .....             | .....            | .....       | .....                               | 29      |
| 866             | 7         | 2160                 | .....                  | 3060              | 3090              | 3152             | 3180        | Fifth sand .....                    | 30      |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | .....                               | 30A     |
| 840             | 10        | 2152                 | .....                  | .....             | 3046              | 3102             | 3300        | B. I., Gnz., 50-ft. & 5th gas ..... | 31      |
| 970             | ..        | 2235                 | 3000                   | .....             | 3210              | .....            | 3465        | B. I. 50-ft. and 4th gas..          | 32      |
| 857             | ..        | 2160                 | 2775                   | .....             | 3090              | .....            | 3267        | 4th gas .....                       | 33      |
| 810             | 10        | 2075                 | .....                  | 2955              | 3050              | 3075             | 3432        | Big I. gas light .....              | 34      |
| 920             | 8         | 2208                 | .....                  | .....             | .....             | .....            | 2936        | B. Dunk., Big I., 50-ft gas .....   | 35      |
| 1190            | 6         | 2430                 | .....                  | 3326              | 3400              | .....            | 3426        | Dry hole .....                      | 36      |
| 1151            | .....     | 2421                 | .....                  | 3285              | .....             | .....            | 3331        | Gord. gas and 4th oil ..            | 37      |
| 995             | 5         | 2268                 | .....                  | 3140              | 3224              | 3265             | 3587        | 50-ft. gas light .....              | 38      |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | .....                               | 39      |
| 867             | 5         | 2132                 | 2858                   | 2955              | 3015              | 3075             | 3454        | 50- ft. gas .....                   | 40      |
| 885             | 8         | 2135                 | .....                  | 2945              | 3085              | 3145             | 3160        | Gord. gas .....                     | 41      |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | Big I. gas .....                    | 42      |
| 1157            | ..        | 2436                 | .....                  | .....             | .....             | .....            | 2506        | Big I. gas .....                    | 43      |
| 1313            | 6         | 2568                 | .....                  | 3438              | 3516              | 3570             | 3985        | Big I. gas .....                    | 44      |
| 920             | ..        | 2220                 | 2945                   | 3085              | .....             | 3202             | .....       | (30-ft.) gas .....                  | 44A     |



## Summarized Record of

| Map No. | NAME OF WELL                    | Location—<br>District | OWNER             | Block<br>A. ? |
|---------|---------------------------------|-----------------------|-------------------|---------------|
| 45      | Abe W. Whisler No. 2407....     | Battelle .....        | Phila .....       | 1170B         |
| 46      | Jacob (B. F.) Liming No. 2..    | Battelle .....        | Fisher .....      | 1225L         |
| 47      | Jacob (B. F.) Liming No. 1..    | Battelle .....        | Fisher .....      | 1370B         |
| 48      | John M. Liming No. 2303....     | Battelle .....        | Phila .....       | 1130B         |
| 49      | Sol S. Lemley No. 1.....        | Battelle .....        | Phila .....       | 1170B         |
| 50      | Amy Maple No. 1.....            | Battelle .....        | Mfg. L. & H. .... | .....         |
| 51      | Fred O. Liming No. 2326....     | Battelle .....        | Phila .....       | 1240B         |
| 52      | Sol M. Shriver No. 2306....     | Battelle .....        | Phila .....       | 1130B         |
| 53      | John Estel Heirs No. 1.....     | Battelle .....        | Mfg. L. & H. .... | .....         |
| 54      | Haught Heirs No. 1.....         | Battelle .....        | Fort Pitt .....   | 1250B         |
| 55      | A. J. Cumberledge No. 2....     | Battelle .....        | South Penn .....  | 1015B         |
| 56      | Juretta Eddy No. 2.....         | Battelle .....        | South Penn .....  | 1275B         |
| 57      | Accha Eddy No. 8.....           | Battelle .....        | South Penn .....  | 970B          |
| 58      | Accha Eddy No. 9.....           | Battelle .....        | South Penn .....  | 1010B         |
| 59      | Accha Eddy No. 4.....           | Battelle .....        | South Penn .....  | .....         |
| 60      | Isaac Strosnider No. 4.....     | Battelle .....        | South Penn .....  | 990B          |
| 61      | Jerry Meriner No. 1.....        | Battelle .....        | South Penn .....  | 1080B         |
| 62      | Eb Bell No. 5.....              | Battelle .....        | South Penn .....  | 1115B         |
| 63      | Eb Bell No. 4.....              | Battelle .....        | South Penn .....  | 928L          |
| 64      | Eb Bell No. 1.....              | Battelle .....        | South Penn .....  | 1033L         |
| 65      | Eli Collins No. 1.....          | Battelle .....        | South Penn .....  | 1120B         |
| 66      | Rufus Bell No. 1.....           | Battelle .....        | Battelle .....    | 1095B         |
| 67      | Rufus Bell No. 1.....           | Battelle .....        | South Penn .....  | 1040B         |
| 68      | Rufus Bell No. 2.....           | Battelle .....        | South Penn .....  | 1030B         |
| 69      | Rufus Bell No. 3.....           | Battelle .....        | South Penn .....  | .....         |
| 70      | Milo Strosnider No. 1.....      | Battelle .....        | Battelle .....    | 1006L         |
| 71      | Josephus Thomas No. 1....       | Battelle .....        | Phila? .....      | 1000B         |
| 72      | Shriver-Haught No. 1.....       | Battelle .....        | Hope .....        | .....         |
| 73      | Henry Fox Heirs No. 1....       | Battelle .....        | South Penn .....  | 1120B         |
| 74      | Zadoc Wise No. 1.....           | Battelle .....        | Battelle .....    | 1010B         |
| 75      | Lewis Fox No. 1.....            | Battelle .....        | Phila .....       | 1040B         |
| 76      | Ezra Cross No. 1.....           | Battelle .....        | Battelle .....    | .....         |
| 77      | W. L. Fox No. 1.....            | Battelle .....        | South Penn .....  | .....         |
| 78      | Sarah E. Eddy No. 11.....       | Battelle .....        | McDermott .....   | 1030B         |
| 79      | Sarah E. Eddy No. 1.....        | Battelle .....        | McDermott .....   | .....         |
| 80      | M. J. Garrison No. 1.....       | Battelle .....        | South Penn .....  | 1120B         |
| 81      | Elihu Eddy Heirs No. 6....      | Battelle .....        | South Penn .....  | 1160B         |
| 82      | M. J. & J. L. Garrison No. 1831 | Battelle .....        | Hope .....        | .....         |
| 83      | Lee V. Tennant No. 1.....       | Battelle .....        | South Penn .....  | 1050B         |
| 84      | A. J. Corrothers No. 1.....     | Battelle .....        | South Penn .....  | .....         |
| 85      | A. J. Corrothers No. 2.....     | Battelle .....        | South Penn .....  | 1090B         |
| 86      | F. M. Efaw No. 1.....           | Battelle .....        | Mfg. L. & H. .... | .....         |
| 87      | F. M. Efaw No. 3.....           | Battelle .....        | Mfg. L. & H. .... | 1115L         |
| 88      | Amon Johnson No. 2.....         | Battelle .....        | Mfg. L. & H. .... | 1083L         |
| 89      | Samuel Eakin No. 4.....         | Battelle .....        | South Penn .....  | 1155B         |
| 90      | Samuel Eakin No. 1.....         | Battelle .....        | South Penn .....  | 1125B         |
| 91      | Ewing Heirs No. 1.....          | Battelle .....        | South Penn .....  | 1135B         |

Wells in Monongalia County—Continued.

| PITTSBURGH COAL |           | Big Injan Sand (top) | Thirty Foot Sand (top) | Gordon Sand (top) | Fourth Sand (top) | Fifth Sand (top) | Total Depth | PRODUCING SAND AND REMARKS | Map No. |
|-----------------|-----------|----------------------|------------------------|-------------------|-------------------|------------------|-------------|----------------------------|---------|
| Depth (top)     | Thickness |                      |                        |                   |                   |                  |             |                            |         |
| 1015            | ..        | 2285                 | .....                  | 3173              | 3208              | .....            | 3282        | 4th gas                    | 45      |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | Big I. gas                 | 46      |
| 1195            | 5         | 2434                 | 3228                   | 3388              | .....             | .....            | 3448        | .....                      | 47      |
| 946             | ..        | 2222                 | .....                  | .....             | .....             | .....            | 2319        | Big I. gas                 | 48      |
| 995             | ..        | 2267                 | 3011                   | 3155              | 3192              | 3240             | 3458        | 30-ft. gas and oil show.   | 49      |
| 1005            | ..        | 2303                 | 3000                   | 3130              | 3225              | .....            | 3308        | 30-ft. gas                 | 50      |
| 1070            | ..        | 2360                 | .....                  | 3210              | 3305              | .....            | 3487        | 6th gas light              | 51      |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | Big I., 30-ft. and Stray   | ..      |
| 935             | ..        | 2225                 | .....                  | 3075              | .....             | .....            | 3095        | gas                        | 52      |
| 1342            | 6         | 2631                 | 3358                   | 3436              | 3526              | 3590             | 3745        | 5th and 6th gas light      | 53      |
| 1970            | ..        | 2380                 | .....                  | .....             | 3296              | 3340             | 3486        | 50-ft. and 6th oil shows.  | 54      |
| 720             | ..        | 2010                 | .....                  | 2900              | 2970              | .....            | 2994        | Big I. gas & oil and       | .....   |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | 4th oil                    | 55      |
| 900             | ..        | 2210                 | .....                  | .....             | 3150              | 3220             | 3237        | Big I. gas, 5th oil        | 56      |
| 678             | ..        | 1940                 | .....                  | .....             | 2922              | .....            | 2952        | 4th oil                    | 57      |
| 730             | ..        | 2007                 | 2735                   | 2895              | 2964              | .....            | 2988        | 4th oil                    | 58      |
| 910             | ..        | 2180                 | .....                  | .....             | 3154              | .....            | 3165        | 4th oil, 1300 bbls. daily  | 59      |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | 4th oil                    | 60      |
| 792             | ..        | .....                | .....                  | 2970              | 3033              | .....            | 3050        | 50-ft. & Gord gas; 4th oil | 61      |
| 830             | ..        | 2085                 | .....                  | .....             | 3062              | .....            | 3085        | 4th oil                    | 62      |
| 730             | ..        | 1990                 | .....                  | .....             | 2967              | .....            | 2998        | 4th oil                    | 63      |
| 740             | ..        | 2030                 | .....                  | 2925              | 2982              | .....            | 3012        | 4th oil                    | 64      |
| 810             | ..        | 2090                 | .....                  | .....             | 3050              | .....            | 3074        | 4th oil                    | 65      |
| 804             | 8         | 2080                 | .....                  | 2930              | 3040              | .....            | 3086        | 4th oil                    | 66      |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | 4th oil                    | 67      |
| 742             | .....     | 1991                 | .....                  | 2877              | 2980              | .....            | 3001        | 4th oil                    | 68      |
| 848             | ..        | 2056                 | .....                  | .....             | 2242              | .....            | 3100        | 4th oil                    | 69      |
| 712             | 10        | 1980                 | .....                  | .....             | 2925              | .....            | 3159        | .....                      | 70      |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | .....                      | 71      |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | .....                      | 72      |
| 830             | ..        | 2090                 | .....                  | 2925              | 3055              | .....            | 3070        | Big I. and 4th gas         | 73      |
| 744             | 10        | .....                | .....                  | .....             | 2938              | .....            | 2986        | 4th gas and oil            | 74      |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | .....                      | 75      |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | Dry hole                   | 76      |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | Big I. gas., 4th oil       | 77      |
| 771             | ..        | 2078                 | .....                  | .....             | 3000              | .....            | 3021        | 4th oil, 10 bbls.          | 78      |
| 974             | ..        | 2246                 | .....                  | 3125              | 3192              | .....            | .....       | Big I. and Gord. gas       | .....   |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | 4th oil                    | 79      |
| 896             | 6         | 2180                 | .....                  | 3042              | 3097              | .....            | 3141        | 50-ft., Gord. gas and oil. | 80      |
| 895             | ..        | 2163                 | .....                  | 3043              | 3113              | .....            | 3160        | 4th oil, 2700 bbls. daily  | 81      |
| 1038            | ..        | 2320                 | 3140                   | 3248              | 3288              | .....            | 3310        | Big I., 50-ft. & 4th gas   | 82      |
| 828             | ..        | 2115                 | .....                  | .....             | 3043              | .....            | 3063        | 4th oil                    | 83      |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | Gord. sand oil             | 84      |
| 782             | ..        | 2088                 | 2820                   | .....             | 3026              | .....            | 3050        | Fourth oil                 | 85      |
| 924             | ..        | 2225                 | .....                  | 3055              | 3129              | .....            | 3147        | Big I. gas, 4th oil        | 86      |
| 876             | 6         | 2170                 | .....                  | .....             | 3076              | .....            | 3096        | Gnz. and 4th oil           | 87      |
| 858             | 9         | 2150                 | .....                  | 3007              | 3064              | .....            | 3086        | 4th oil                    | 88      |
| 962             | 8         | 2245                 | .....                  | .....             | 3120              | .....            | 3194        | Stray & Gord. oil          | 89      |
| 927             | 10        | .....                | .....                  | 3081              | .....             | .....            | 3112        | Gnz. gas, Gord. oil        | 90      |
| 924             | ..        | 2200                 | 2969                   | 3090              | .....             | .....            | .....       | Gnz. gas, Gord. oil        | 91      |

## Summarized Record of

| Map No. | NAME OF WELL                              | Location—<br>District | OWNER               | Revised<br>A. T. |
|---------|---|-----------------------|---------------------|------------------|
| 92      | M. J. Garrison No. 1.....                 | Battelle .....        | South Penn .....    | ....             |
| 93      | M. J. (Crocker) Garrison<br>No. 1.....    | Battelle .....        | South Penn .....    | 1075B            |
| 94      | M. J. Garrison No. 2.....                 | Battelle .....        | South Penn .....    | 1055B            |
| 95      | Joseph Estil No. 9.....                   | Battelle .....        | South Penn .....    | 1105B            |
| 96      | Wilson Haught No. 4.....                  | Battelle .....        | South Penn .....    | ....             |
| 97      | Wilson Haught No. 3.....                  | Battelle .....        | South Penn .....    | 1160B            |
| 98      | Granville Leggett No. 1.....              | Battelle .....        | Fleming .....       | 1105B            |
| 99      | J. M. Hall No. 2.....                     | Battelle .....        | Mfg. L. & H. ....   | ....             |
| 100     | E. B. Hall No. 2.....                     | Battelle .....        | Mfg. L. & H. ....   | 1130B            |
| 100A    | Eli Delaney core test.....                | Battelle .....        | Thompson .....      | 1132L            |
| 101     | E. B. Hall No. 1.....                     | Battelle .....        | Mfg. L. & H. ....   | 1080B            |
| 102     | J. M. Hall No. 1.....                     | Battelle .....        | Chartiers .....     | 1070L            |
| 103     | F. M. Renner No. 1.....                   | Battelle .....        | South Penn .....    | 1103L            |
| 104     | Wm. Kinney No. 2.....                     | Battelle .....        | Mfg. L. & H. ....   | ....             |
| 105     | Robt. Weir No. 2.....                     | Battelle .....        | South Penn .....    | 1160B            |
| 106     | Louie Haught No. 1.....                   | Battelle .....        | South Penn .....    | 1410B            |
| 107     | W. A. Yost No. 5.....                     | Battelle .....        | South Penn .....    | 1295B            |
| 108     | T. C. Gallagher No. 1.....                | Battelle .....        | South Penn .....    | 1630L            |
| 109     | T. C. Gallagher No. 2.....                | Battelle .....        | South Penn .....    | 1622L            |
| 110     | Anna Harvey No. 1.....                    | Battelle .....        | South Penn .....    | 1120B            |
| 111     | S. J. Harvey No. 7.....                   | Battelle .....        | South Penn .....    | 1095B            |
| 112     | Susan Ammons No. 1.....                   | Battelle .....        | South Penn .....    | 1055B            |
| 113     | Elizabeth Haught No. 1.....               | Battelle .....        | South Penn .....    | 1140B            |
| 114     | S. J. Harvey No. 4.....                   | Battelle .....        | South Penn .....    | ....             |
| 115     | Anna Harvey No. 3.....                    | Battelle .....        | South Penn .....    | 1235B            |
| 116     | Jas. Brookover No. 3.....                 | Battelle .....        | South Penn .....    | 1165B            |
| 117     | Corbra Anderson No. 2.....                | Battelle .....        | South Penn .....    | 1617L            |
| 118     | Corbra Anderson No. 3.....                | Battelle .....        | South Penn .....    | 1616L            |
| 119     | Alice Pyles (Seth Tennant)<br>No. 1 ..... | Battelle .....        | Hope .....          | 1230B            |
| 120     | Catherine Gump No. 3.....                 | Battelle .....        | South Penn .....    | 1200B            |
| 121     | Lewis Gump No. 3.....                     | Battelle .....        | Easton et al? ..... | ....             |
| 122     | Lewis Gump No. 1.....                     | Battelle .....        | Easton et al .....  | 1185B            |
| 123     | Haught & Walker No. 24.....               | Battelle .....        | South Penn .....    | 1420B            |
| 124     | Haught & Walker No. 13.....               | Battelle .....        | South Penn .....    | 1220B            |
| 125     | Denny Tennant No. 8.....                  | Battelle .....        | South Penn .....    | 1515B            |
| 126     | S. T. Fordyce No. 1.....                  | Battelle .....        | South Penn .....    | 1535B            |
| 127     | Jos. & W. L. Parks No. 1.....             | Battelle .....        | South Penn .....    | 1080B            |
| 128     | Jas. Fox No. 1.....                       | Battelle .....        | South Penn .....    | 1115B            |
| 129     | Abraham Shriver No. 1.....                | Battelle .....        | South Penn .....    | 1090B            |
| 130     | James L. Parks No. 1.....                 | Battelle .....        | South Penn .....    | 1000B            |
| 131     | R. S. Thomas No. 1.....                   | Clay .....            | Mellon Bros. ....   | 968L             |
| 132     | R. S. Thomas No. 1.....                   | Clay .....            | Tim Ross .....      | 975L             |
| 133     | Elizabeth Tennant No. 1.....              | Clay .....            | South Penn .....    | 975B             |
| 134     | Jacob Minor Heirs No. 1.....              | Clay .....            | Carnegie .....      | 975B             |
| 135     | Estella & R. S. Lantz<br>No. 1589.....    | Clay .....            | Phila .....         | ....             |
| 136     | Estella & R. S. Lantz<br>No. 1575.....    | Clay .....            | Phila .....         | 955B             |

## Wells in Monongalia County—Continued.

| PITTSBURGH COAL |           | Big Injan Sand (top) | Thirty Foot (top) | Gordon Sand (top) | Fourth Sand (top) | Fifth Sand (top) | Total Depth | PRODUCING SAND AND REMARKS             | Map No. |
|-----------------|-----------|----------------------|-------------------|-------------------|-------------------|------------------|-------------|--|---------|
| Depth (top)     | Thickness |                      |                   |                   |                   |                  |             |  |         |
| 885             | ..        | 2180                 | 2975              | 3034              | 3134              | .....            | 3169        | 4th oil show .....                     | 92      |
| 885             | 10        | 2175                 | .....             | .....             | 3118              | .....            | 3140        | Gnz. and 4th oil .....                 | 93      |
| 930             | ..        | 2210                 | .....             | .....             | 3175              | .....            | 3199        | 50-ft. gas, 4th oil .....              | 94      |
| 1244            | 9         | 2545                 | 3263              | 3391              | 3495              | .....            | 3518        | Big I. gas, 4th oil .....              | 95      |
| .....           | .....     | .....                | .....             | .....             | .....             | .....            | .....       | 4th oil, 500 bbls. ....                | 96      |
| .....           | .....     | .....                | .....             | .....             | .....             | .....            | .....       | 4th oil .....                          | 97      |
| 816?            | ..        | .....                | .....             | .....             | .....             | .....            | .....       | 4th oil, light .....                   | 98      |
| 1160            | ..        | 2450                 | 3177              | 3323½             | .....             | .....            | 3344½       | 4th oil .....                          | 99      |
| 977             | 11        | 2252                 | .....             | 3122              | .....             | .....            | 3161        | 50-ft., 30-ft., & Gord. oil.           | 99      |
| 925             | ..        | 2235                 | .....             | 3081              | .....             | .....            | 3107        | 30-ft. & Gord. oil .....               | 100     |
| .....           | .....     | .....                | .....             | .....             | .....             | .....            | .....       | Gord. gas and oil .....                | 101     |
| .....           | .....     | .....                | .....             | .....             | .....             | .....            | .....       | .....                                  | 100A    |
| 916             | ..        | 2228                 | .....             | 3072              | 3145              | .....            | 3155        | Gord. oil .....                        | 102     |
| 928             | ..        | 2230                 | .....             | 3091              | 3179              | .....            | 3198        | Gord. & 4th oil .....                  | 103     |
| 1216            | ..        | 2321                 | .....             | 3261              | 3358              | .....            | 3383        | Gord. & 4th oil .....                  | 104     |
| .....           | .....     | .....                | .....             | .....             | .....             | .....            | .....       | Gord. & 4th oil .....                  | 105     |
| .....           | .....     | .....                | .....             | .....             | .....             | .....            | .....       | 4th oil .....                          | 106     |
| 1105            | ..        | 2398                 | 2890              | 3264              | 3359              | .....            | 3395        | Gord. & 4th oil .....                  | 107     |
| 1294            | 8         | 2580                 | .....             | .....             | 3514½             | .....            | 3540        | Big I. and 4th oil .....               | 108     |
| 1292            | ..        | 2600                 | .....             | .....             | 3513½             | .....            | 3534½       | 4th oil .....                          | 109     |
| 780             | ..        | 2080                 | .....             | .....             | 2995              | .....            | 3012        | 4th oil, 2200 bbls. ....               | 110     |
| 750             | ..        | 2045                 | .....             | 2960              | 2989              | .....            | 3021        | 4th oil .....                          | 111     |
| 675             | ..        | .....                | .....             | .....             | 2925              | .....            | 3175        | 5th gas show .....                     | 112     |
| 793             | ..        | 2100                 | .....             | .....             | 3015              | .....            | 3073        | 4th oil .....                          | 113     |
| 1145            | ..        | 2477                 | .....             | 3340              | 3361              | 3398             | 3408½       | 4th oil .....                          | 114     |
| 920             | ..        | 2225                 | .....             | .....             | 3130              | .....            | 3152        | B. I. & 50-ft. gas, 4th oil.           | 115     |
| .....           | .....     | .....                | .....             | .....             | .....             | .....            | .....       | Dry hole .....                         | 115     |
| 1315            | 10        | 2614                 | .....             | 3528              | 3528              | none             | 3769        | B. I. gas, 4th oil .....               | 117     |
| .....           | .....     | .....                | .....             | .....             | .....             | .....            | .....       | 4th oil .....                          | 118     |
| .....           | .....     | .....                | .....             | .....             | .....             | .....            | .....       | .....                                  | 119     |
| 925             | ..        | 2181                 | .....             | 3131              | 3172              | .....            | 3200        | 50-ft. gas. ....                       | 119     |
| 890             | ..        | 2195                 | .....             | .....             | 3117              | .....            | 3206        | 5th sand oil .....                     | 120     |
| 894             | 7         | 2190                 | .....             | .....             | 3127              | .....            | 3176        | 4th, 300 bbls. ....                    | 121     |
| 870             | 10        | 2170                 | .....             | .....             | 3105              | .....            | 3162        | 4th oil, 65 bbls. ....                 | 122     |
| 1104            | ..        | 2380                 | .....             | 3270              | 3315              | .....            | 3525        | 4th and 6th oil .....                  | 123     |
| 909             | ..        | 2183                 | .....             | .....             | 3130              | .....            | 3146        | 50-ft. gas, 4th oil,<br>500 bbls. .... | 124     |
| 1210            | ..        | 2500                 | .....             | .....             | 3429              | .....            | 3438        | 4th oil, 20 bbls. ....                 | 125     |
| 1256            | 10        | 2545                 | .....             | 3467              | 3493              | .....            | 3515        | 4th oil, 427 bbls. ....                | 126     |
| 780             | ..        | 2050                 | .....             | 2980              | .....             | 3090             | 3193        | 4th, 5th & 6th gas .....               | 127     |
| .....           | .....     | .....                | .....             | .....             | .....             | .....            | .....       | .....                                  | 128     |
| 780             | ..        | 2100                 | 3795              | .....             | 3007              | .....            | 3048        | 4th gas, heavy .....                   | 129     |
| 683             | ..        | 1963                 | .....             | 2842              | 2917              | 3070             | 3185        | B. I. and 6th gas .....                | 130     |
| 640             | ..        | 1915                 | .....             | .....             | .....             | .....            | 2096        | B. I. gas .....                        | 131     |
| .....           | .....     | .....                | .....             | .....             | .....             | .....            | .....       | Big I. gas .....                       | 132     |
| .....           | .....     | .....                | .....             | .....             | .....             | .....            | .....       | 4th oil show .....                     | 133     |
| 625             | ..        | .....                | .....             | .....             | .....             | .....            | .....       | .....                                  | 134     |
| 628             | ..        | 1948                 | .....             | .....             | .....             | .....            | 2064        | Big I. gas .....                       | 135     |
| 570             | ..        | 1905                 | .....             | .....             | .....             | .....            | 1990        | Big I. gas .....                       | 136     |

## Summarized Record of

| Map No. | NAME OF WELL                            | Location - District | OWNER              | Errors A. ? |
|---------|---|---------------------|--------------------|-------------|
| 137     | Estella & R. S. Lantz<br>No. 1576 ..... | Clay .....          | Phila .....        | 953L        |
| 138     | Strosnider No. 1 .....                  | Clay .....          | Scott .....        | 946L        |
| 139     | Remembrance Lantz No. 3 .....           | Clay .....          | Phila .....        | 1035B       |
| 140     | Wm. Scott No. 1 .....                   | Wayne (Pa.) .....   | South Penn .....   | 1117L       |
| 141     | Jos. Marshall No. 1 .....               | Clay .....          | Phila .....        | .....       |
| 142     | E. C. Henkins No. 1 .....               | Clay .....          | Hope .....         | 1060B       |
| 143     | Josiah Devine No. 1 .....               | Clay .....          | Phila .....        | 1105B       |
| 144     | J. W. Brock No. 1 .....                 | Clay .....          | South Penn .....   | 1030B       |
| 145     | R. S. Lantz No. 1 .....                 | Clay .....          | South Penn .....   | .....       |
| 146     | Marion Tennant No. 1 .....              | Clay .....          | Hope .....         | 1425B       |
| 147     | Sol Meyers No. 1 .....                  | Clay .....          | Carnahan .....     | 1104L       |
| 148     | Sol Meyers No. 1 .....                  | Clay .....          | McDermott .....    | 1110B       |
| 149     | Reason Sine No. 1 .....                 | Clay .....          | Carnahan .....     | 1239L       |
| 150     | Alph Sine No. 1 .....                   | Clay .....          | Carnahan .....     | 1152L       |
| 151     | Alph Sine No. 2 .....                   | Clay .....          | Carnahan .....     | 1274L       |
| 152     | Asa Lemley No. 2 .....                  | Clay .....          | Carter .....       | 1195B       |
| 153     | Jas. Lemley Heirs No. 1 .....           | Clay .....          | Fisher .....       | 1225B       |
| 154     | Asa Lemley No. 3 .....                  | Clay .....          | .....              | 1235B       |
| 155     | Asa Lemley No. 1 .....                  | Clay .....          | .....              | 1345B       |
| 156     | D. S. Lemley No. 2 .....                | Clay .....          | South Penn .....   | 1335B       |
| 157     | J. N. Wilson No. 1 .....                | Clay .....          | Chartiers .....    | .....       |
| 158     | D. S. Lemley No. 1 .....                | Clay .....          | South Penn .....   | 1480B       |
| 159     | D. S. Lemley No. 1 .....                | Clay .....          | Chartiers .....    | 1165B       |
| 160     | Isaac Cook No. 2 .....                  | Clay .....          | Daybrook .....     | 1220B       |
| 161     | Isaac Cook No. 1 .....                  | Clay .....          | Daybrook .....     | 1215B       |
| 162     | Marlon Tennant No. 1 .....              | Clay .....          | Chartiers .....    | 1160B       |
| 163     | John Henderson Heirs No. 1 .....        | Clay .....          | Chartiers .....    | 1020B       |
| 164     | Mary Berry No. 1 .....                  | Clay .....          | Chartiers .....    | 990B        |
| 165     | John Moore No. 1 .....                  | Clay .....          | Chartiers .....    | 960B        |
| 166     | Daniel Moore No. 2 .....                | Clay .....          | Chartiers .....    | 1060B       |
| 167     | D. R. Wright No. 1 .....                | Clay .....          | Hope .....         | 980B        |
| 168     | Grant Stevens coal test .....           | Clay .....          | J. E. Barnes ..... | 960B        |
| 169     | S. P. Tennant Heirs No. 1 .....         | Clay .....          | Hope .....         | 955B        |
| 170     | Etta Core No. 1 .....                   | Clay .....          | Hope .....         | 1100B       |
| 171     | Etta Core No. 2268 .....                | Clay .....          | Hope .....         | 1345B       |
| 172     | Lee R. Shriver No. 2 .....              | Clay .....          | South Penn .....   | 965B        |
| 173     | J. O. & E. Price No. 1 .....            | Clay .....          | McDermott .....    | 990B        |
| 174     | Lee R. Shriver No. 3 .....              | Clay .....          | South Penn .....   | 975B        |
| 175     | A. B. Price No. 1 .....                 | Clay .....          | South Penn .....   | .....       |
| 176     | Lee Shriver No. 1 .....                 | Clay .....          | South Penn .....   | 925B        |
| 177     | Brown Heirs No. 1 .....                 | Clay .....          | South Penn .....   | 955B        |
| 178     | John Blair No. 1 .....                  | Clay .....          | South Penn .....   | .....       |
| 179     | Nicholas Petty No. 1 .....              | Clay .....          | South Penn .....   | 965B        |
| 180     | E. B. Toothman No. 1 .....              | Clay .....          | Pure .....         | 1110B       |
| 181     | W. R. Shuman No. 4 .....                | Clay .....          | South Penn .....   | 1335B       |
| 182     | Wilson Heirs No. 11 .....               | Clay .....          | South Penn .....   | 1635B       |
| 183     | C. M. Toothman No. 4 .....              | Clay .....          | Fisher .....       | 1055B       |
| 184     | C. M. Toothman No. 1 .....              | Clay .....          | Fisher .....       | 1055B       |
| 185     | M. A. Ammons No. 3 .....                | Clay .....          | South Penn .....   | 1082L       |

## Wells in Monongalia County—Continued.

| PITTSBURGH COAL |           | Big Injun Sand (top) | Thirty Foot Sand (top) | Gordon Sand (top) | Fourth Sand (top) | Fifth Sand (top) | Total Depth | PRODUCING SAND AND REMARKS             | Map No. |
|-----------------|-----------|----------------------|------------------------|-------------------|-------------------|------------------|-------------|--|---------|
| Depth (top)     | Thickness |                      |                        |                   |                   |                  |             |  |         |
| 561             | 8         | 1880                 |                        |                   |                   |                  | 1980        | Big I. gas . . . . .                   | 137     |
| 555             | ..        |                      |                        |                   |                   |                  | ..          | B. I. and 5th oil . . . . .            | 138     |
| 640             | ..        |                      |                        |                   |                   |                  | ..          | Big I. gas . . . . .                   | 139     |
| 720             | ..        | 2035                 |                        |                   |                   |                  | 3052        | 5th oil . . . . .                      | 140     |
| 717             | 11        |                      |                        |                   |                   |                  | 3220        | Dry hole . . . . .                     | 141     |
| 737             | ..        |                      |                        |                   |                   |                  | ..          | ..                                     | 142     |
| 660             | ..        | 1968                 |                        |                   | 2948              |                  | 3163        | Light gas . . . . .                    | 143     |
| 1105            | ..        | 2385                 |                        |                   | 3350              | 3400             | 3555        | Oil show . . . . .                     | 144     |
| 744             | ..        | 2034                 |                        |                   |                   |                  | 2162        | B. I. & 6th gas . . . . .              | 145     |
| 756             | ..        | 2051                 |                        |                   |                   |                  | 2256½       | B. I. oil . . . . .                    | 146     |
| 890             | ..        | 2185                 |                        |                   |                   |                  | 2245        | B. I. gas, light . . . . .             | 147     |
| 800             | ..        | 2080                 |                        |                   |                   |                  | 2214        | B. I. oil . . . . .                    | 148     |
| 916             | ..        | 2109                 |                        |                   | 3185              | 3246             | 3371        | B. I. oil . . . . .                    | 149     |
| 846             | 9         | 2132                 | 2930                   |                   | 3116              |                  | 3447        | B. I. gas . . . . .                    | 150     |
| 875             | ..        | 2155                 |                        |                   |                   |                  | 2298        | B. I. & 6th oil . . . . .              | 151     |
| 990             | 10        | 2295                 |                        |                   |                   |                  | 2410        | B. I. gas . . . . .                    | 152     |
| 1017            | ..        | 2290                 |                        |                   |                   |                  | 2412        | B. I. oil, light . . . . .             | 153     |
| 1155            | ..        | 2436                 |                        |                   |                   |                  | 2542        | B. I. oil . . . . .                    | 154     |
| 856             | 6         | 2116½                |                        |                   |                   |                  | ..          | B. I. oil . . . . .                    | 155     |
| 795             | ..        | 2100                 |                        |                   | 3012              |                  | 3220?       | B. I. oil . . . . .                    | 156     |
| 635             | ..        | 1932                 |                        |                   |                   |                  | 3238        | B. I. & 6th gas . . . . .              | 157     |
| 596             | ..        | 1895                 |                        |                   |                   |                  | 2026½       | 4th gas, B. I. & 6th oil . . . . .     | 158     |
| 555             | ..        | 1860                 |                        |                   | 2786              | 2824             | 3261        | B. I. gas . . . . .                    | 159     |
| 572             | ..        |                      |                        |                   |                   | 3020             | 3045½       | 6th gas . . . . .                      | 160     |
| 507             | ..        | 1753                 |                        |                   | 2715              |                  | 2919        | 6th gas . . . . .                      | 161     |
| 477             | 10        |                      |                        |                   |                   |                  | 488         | B. I., Gord. & 6th gas . . . . .       | 162     |
| 467?            | ..        |                      |                        |                   |                   |                  | ..          | ..                                     | 163     |
| 624             | ..        |                      |                        |                   |                   |                  | ..          | ..                                     | 164     |
| 892             | 10        | 2145                 |                        | 3120              | 3150              | 3188             | 3348        | B. I. & 6th gas . . . . .              | 165     |
| 535             | ..        | 1755                 | 2570                   | 2760              | 2790              | 2840             | 2960½       | B. I. & 6th oil . . . . .              | 166     |
| 552             | 9         | 1820                 |                        | 2675              |                   | 2835             | 3190        | B. I. & 6th oil show . . . . .         | 167     |
| 540             | ..        | 1790                 |                        |                   |                   |                  | 2968        | B. I. & 6th oil . . . . .              | 168     |
| 535             | ..        | 1755                 |                        |                   | 2760              | 2840             | 2960½       | 6th oil . . . . .                      | 169     |
| 520?            | ..        | 1840                 |                        |                   | 2740              | 2795             | 2830        | B. I. & 6th oil and gas . . . . .      | 170     |
| 538             | ..        | 1820                 |                        |                   |                   |                  | 2990        | B. I. oil, 5th gas . . . . .           | 171     |
| 676             | ..        | 1976                 |                        |                   |                   |                  | 2086        | 6th oil . . . . .                      | 172     |
| 932             | ..        | 2232                 |                        | 3142              |                   |                  | 3382        | B. I. gas, 6th oil . . . . .           | 173     |
| 1228            | ..        | 2512                 |                        |                   | 3438              |                  | 3658        | B. I. & 6th oil . . . . .              | 174     |
| 570             | 8         | 1895                 |                        | 2780              | 2830              |                  | 3003        | 6th oil . . . . .                      | 175     |
| 575             | ..        |                      |                        |                   |                   |                  | 1300?       | Oil, 12 bbls. daily at first . . . . . | 176     |
| 575             | ..        | 1885                 |                        |                   |                   |                  | 2012        | B. I. & 6th oil . . . . .              | 177     |
|                 |           |                      |                        |                   |                   |                  |             | B. I. oil . . . . .                    | 178     |
|                 |           |                      |                        |                   |                   |                  |             | B. I. oil . . . . .                    | 179     |
|                 |           |                      |                        |                   |                   |                  |             | B. I. oil . . . . .                    | 180     |
|                 |           |                      |                        |                   |                   |                  |             | B. I. oil . . . . .                    | 181     |
|                 |           |                      |                        |                   |                   |                  |             | B. I. oil . . . . .                    | 182     |
|                 |           |                      |                        |                   |                   |                  |             | B. I. oil . . . . .                    | 183     |
|                 |           |                      |                        |                   |                   |                  |             | B. I. oil . . . . .                    | 184     |
|                 |           |                      |                        |                   |                   |                  |             | B. I. oil . . . . .                    | 185     |

## Summarized Record of

| Map No. | NAME OF WELL                    | Location—<br>District | OWNER               | Elevation<br>A. T. |
|---------|---------------------------------|-----------------------|---------------------|--------------------|
| 186     | C. W. Yost No. 1.....           | Clay .....            | Hope .....          | .....              |
| 187     | John T. Neeley No. 1.....       | Clay .....            | Carnegie .....      | .....              |
| 188     |                                 | Clay .....            |                     | 1480L              |
| 189     | Arthela (James) Eddy No. 6..    | Clay .....            | South Penn .....    | 1310B              |
| 190     | Reason Tennant No. 4.....       | Clay .....            | South Penn .....    | 1470B              |
| 191     | Daniel L. Toothman No. 12..     | Clay .....            | South Penn .....    | 1660L              |
| 192     | David L. Ammons No. 1.....      | Clay .....            |                     | 1085B              |
| 193     | E. J. Ammons Heirs No. 7..      | Clay .....            | Delmar .....        | 1160B              |
| 194     | Arthela Eddy No. 8.....         | Clay .....            | South Penn .....    | 1170B              |
| 195     | Presley Tennant No. 7.....      | Clay .....            | South Penn .....    | 1165B              |
| 196     | Simeon Tennant No. 12.....      | Clay .....            | South Penn .....    | 1195B              |
| 197     | Alcinda Lemley No. 2(?)....     | Clay .....            | South Penn .....    | .....              |
| 198     | Enoch Tennant No. 1.....        | Clay .....            | South Penn .....    | .....              |
| 199     | Albert Tennant Heirs No. 3..    | Clay .....            | South Penn .....    | 1105B              |
| 200     | Malinda Tennant No. 3.....      | Clay .....            | South Penn .....    | 995B               |
| 201     | Jos. Varner No. 5.....          | Clay .....            | Alpha .....         | .....              |
| 202     | Mahala McCord Heirs No. 1..     | Clay .....            | Chartiers .....     | 1350B              |
| 203     | Noah Brewer No. 1.....          | Clay .....            | Hope .....          | .....              |
| 204     | Asa Tennant No. 9.....          | Clay .....            | McDermott .....     | 1019L              |
| 205     | Eliza Tennant No. 1.....        | Clay .....            | Carr Bros .....     | 985L               |
| 206     | Mary E. Tennant No. 1.....      | Clay .....            | McDermott .....     | 985L               |
| 207     | Minor Tennant No. 1.....        | Clay .....            | Chartiers .....     | 970B               |
| 208     | Daniel Moore No. 2.....         | Clay .....            | Chartiers .....     | 1070B              |
| 209     | Noah Wright No. 3.....          | Clay .....            | South Penn .....    | .....              |
| 210     | D. J. Eddy No. 3.....           | Clay .....            | South Penn .....    | 1090B              |
| 211     | D. J. Eddy core test.....       | Clay .....            |                     | 1058L              |
| 212     | D. E. Cordray No. 4.....        | Clay .....            | South Penn .....    | 1391L              |
| 213     | Simon Wildman No. 15.....       | Clay .....            | South Penn .....    | 1035L              |
| 214     | C. E. Johnson No. 8.....        | Clay .....            | South Penn .....    | 1280B              |
| 215     | C. E. Johnson No. 1.....        | Clay .....            | South Penn .....    | 1340B              |
| 216     | C. E. Johnson No. 5.....        | Clay .....            | South Penn .....    | 1325B              |
| 217     | M. C. Wildman No. 1123.....     | Clay .....            | Hope .....          | 1130B              |
| 217A    | D. E. Lemley No. 1.....         | Clay .....            | Hukill .....        | 1000B              |
| 218     | Benj. (Kate) Core No. 1.....    | Clay .....            | Chartiers .....     | 949L               |
| 219     | Kate Core No. 2.....            | Clay .....            | Chartiers .....     | 950B               |
| 220     | Asa Sutton No. 6.....           | Clay .....            | South Penn .....    | 1485B              |
| 221     | C. C. Core No. 3.....           | Clay .....            | South Penn .....    | 1440B              |
| 222     | Thos. Sutton No. 2.....         | Clay .....            | South Penn .....    | 1365B              |
| 223     | C. C. Core No. 7.....           | Clay .....            | South Penn .....    | 1340B              |
| 224     | J. C. and R. Morris No. 1....   | Clay .....            | South Penn .....    | 1205B              |
| 225     | Margaret Davis No. 1.....       | Clay .....            | South Penn .....    | 1100B              |
| 226     | G. & L. Morris et al.....       | Clay .....            | South Penn .....    | .....              |
| 227     | Margaret Davis No. 2.....       | Clay .....            | W. Va. T. & E. .... | 1110B              |
| 228     | Thornton Miller Heirs No. 1..   | Clay .....            |                     | 1140B              |
| 230     | Martha A. Miller No. 1.....     | Clay .....            | W. Va. T. & E. .... | 1225B              |
| 231     | Aaron Hawkins No. 1.....        | Clay .....            | W. Va. T. & E. .... | .....              |
| 232     | Cal Hawkins No. 1.....          | Clay .....            | W. Va. T. & E. .... | .....              |
| 233     | M. A. Miller No. 2.....         | Clay .....            | W. Va. T. & E. .... | 1015B              |
| 234     | M. A. Miller coal test No. 9'.. | Clay .....            | Consolidation ..... | 1010B              |





## Summarized Record of

| Map No. | NAME OF WELL                         | Location—District | OWNER          | Revised A. T. |
|---------|--------------------------------------|-------------------|----------------|---------------|
| 234A    | D. F. Morris No. 2618.....           | Clay              | Hope           | .....         |
| 235     | Newton Varner No. 1.....             | Clay              | Hope           | .....         |
| 236     | H. P. Wilson No. 1.....              | Clay              | .....          | .....         |
| 237     | Jacob A. Eddy No. 1.....             | Clay              | Hope           | 1040B         |
| 238     | Isaac S. Eddy No. 1.....             | Clay              | Carnegie       | 1170B         |
| 239     | Asa Sutton No. 1.....                | Cass              | Hukill         | 1430B         |
| 239A    | C. C. Core No. 2.....                | Cass              | South Penn     | 1355B         |
| 240     | David Wise (J. Henderson) No. 4..... | Cass              | Spindletop     | .....         |
| 241     | W. P. Core No. 9.....                | Cass              | South Penn     | .....         |
| 242     | Almeda Dorsey No. 1.....             | Cass              | .....          | 1020B         |
| 243     | M. L. Core No. 3.....                | Cass              | Duquesne       | 1120B         |
| 244     | Donley & Core No. 1.....             | Cass              | W. Va. T. & E. | 1020B         |
| 245     | D. L. Donley.....                    | Perry (Pa.)       | Hukill         | 920B          |
| 246     | D. L. Donley.....                    | Perry (Pa.)       | .....          | .....         |
| 247     | John Gump.....                       | Perry (Pa.)       | .....          | .....         |
| 248     | I. Bowby No. 1.....                  | Perry (Pa.)       | W. Va. T. & E. | 1310B         |
| 249     | Roy McClernan No. 1.....             | Perry (Pa.)       | W. Va. T. & E. | 1260B         |
| 250     | Bowen Wade No. 2.....                | Perry (Pa.)       | Randall        | 1190B         |
| 251     | I. Bowlby No. 3.....                 | Cass              | W. Va. T. & E. | 1130B         |
| 252     | Spencer M. Cunningham No. 2.....     | Cass              | Mt. Morris     | 1195B         |
| 253     | S. Wade No. 1.....                   | Cass              | W. Va. T. & E. | 1085B         |
| 254     | Spencer Cunningham No. 1.....        | Cass              | W. Va. T. & E. | 1255B         |
| 255     | Iona Bowlby No. 4.....               | Cass              | W. Va. T. & E. | 1220B         |
| 256     | H. C. Bowlby No. 5.....              | Cass              | W. Va. T. & E. | .....         |
| 257     | E. Brand No. 2.....                  | Cass              | W. Va. T. & E. | .....         |
| 258     | Geo. Weaver No. 1.....               | Cass              | W. Va. T. & E. | 1180B         |
| 259     | Wm. McCormick No. 2.....             | Cass              | W. Va. T. & E. | 1245B         |
| 260     | Frank McCormick No. 1.....           | Cass              | W. Va. T. & E. | 1215B         |
| 261     | John Brand No. 1.....                | Cass              | Home Gas       | 1230B         |
| 262     | Mark Weaver No. 1.....               | Cass              | W. Va. T. & E. | 1245B         |
| 263     | Justus Brewer No. 1.....             | Cass              | W. Va. T. & E. | 1000B         |
| 264     | Jas. Kennedy No. 1.....              | Cass              | W. Va. T. & E. | 925B          |
| 265     | A. Cole.....                         | Cass              | W. Va. T. & E. | .....         |
| 266     | Wm. Higgins No. 1.....               | Cass              | W. Va. T. & E. | 975B          |
| 267     | Mankedick Heirs coal test No. 3..... | Cass              | Consolidation  | 963L          |
| 268     | A. L. Sutton.....                    | Cass              | W. Va. T. & E. | .....         |
| 268A    | Amasa Cole No. 1.....                | Cass              | Hukill         | .....         |
| 269     | David Henderson No. 1.....           | Cass              | W. Va. T. & E. | 1340B         |
| 270     | Chas. E. Core No. 1.....             | Cass              | W. Va. T. & E. | 1165B         |
| 271     | Clark Lemley No. 1.....              | Cass              | W. Va. T. & E. | 1230B         |
| 272     | John Laird (E. Roach) No. 1.....     | Cass              | W. Va. T. & E. | 1135B         |
| 273     | Elza Davis No. 1.....                | Cass              | W. Va. T. & E. | 1050B         |
| 274     | Wm. H. Smith No. 1.....              | Cass              | W. Va. T. & E. | 1155B         |
| 275     | E. H. Clevenger No. 1.....           | Cass              | Randall        | 1170B         |
| 276     | W. P. Evely.....                     | Cass              | W. Va. T. & E. | .....         |
| 277     | James Sanders No. 1.....             | Cass              | W. Va. T. & E. | .....         |
| 278     | John Sanders.....                    | Cass              | W. Va. T. & E. | .....         |
| 279     | Jasper Stone No. 1.....              | Cass              | Randall        | 895B          |

## Wells in Monongalia County—Continued.

| PITTSBURGH COAL |           | Big Injun Sand (top) | Thirty Foot Sand (top) | Gordon Sand (top) | Fourth Sand (top) | Fifth Sand (top) | Total Depth | PRODUCING SAND AND REMARKS | Map No. |
|-----------------|-----------|----------------------|------------------------|-------------------|-------------------|------------------|-------------|----------------------------|---------|
| Depth (top)     | Thickness |                      |                        |                   |                   |                  |             |                            |         |
| 510             | 5         | 1800                 | .....                  | 2629              | 2785              | 2841             | 2912        | 5th oil, Big I. gas ....   | 234A    |
| 579             | ..        | 1886                 | .....                  | .....             | .....             | .....            | 2059        | Big I. gas .....           | 235     |
| 460             | ..        | 1735                 | .....                  | .....             | 2700              | 2815             | 2974        | Dry hole .....             | 236     |
| 570             | 10        | 1860                 | .....                  | .....             | 2800              | 2875             | 3013        | Dry hole .....             | 237     |
| 805             | ..        | 2088                 | .....                  | .....             | .....             | .....            | .....       | Big I. gas, light .....    | 238     |
| 532             | ..        | 1840                 | .....                  | .....             | .....             | .....            | .....       | Big I. oil .....           | 239     |
| 368             | ..        | 1635                 | .....                  | .....             | .....             | .....            | .....       | Big I. oil .....           | 239A    |
| 413             | 10        | 1740                 | .....                  | .....             | .....             | .....            | .....       | Big I. oil .....           | 240     |
| 376             | 8         | 1655                 | .....                  | .....             | .....             | .....            | .....       | Big I. oil .....           | 241     |
| 520             | 10        | 1826                 | .....                  | .....             | .....             | .....            | .....       | Big I. oil .....           | 242     |
| 462             | 10        | .....                | .....                  | .....             | .....             | .....            | .....       | Big I. gas .....           | 242     |
| 709             | 15        | .....                | .....                  | .....             | .....             | .....            | .....       | Big I. oil .....           | 243     |
| 493?            | ..        | .....                | .....                  | .....             | .....             | .....            | .....       | Big I. gas, light .....    | 244     |
| 444             | ..        | 1754                 | .....                  | .....             | .....             | .....            | .....       | Big I. gas .....           | 244     |
| 466             | 8         | 1692                 | .....                  | .....             | .....             | .....            | .....       | Big I. oil .....           | 245     |
| 423             | 8         | 1748                 | .....                  | .....             | .....             | .....            | .....       | Big I. oil .....           | 246     |
| 477             | 8         | 1786                 | .....                  | 2695              | 2759              | 2816             | 2993        | Big I. gas .....           | 247     |
| 220             | 10        | 1542                 | .....                  | 2511              | 2551              | 2585             | 2720        | Big I. gas .....           | 248     |
| 455             | 8         | .....                | .....                  | .....             | .....             | .....            | .....       | Big I. gas .....           | 249     |
| 178             | 8         | 1504                 | .....                  | .....             | .....             | .....            | .....       | Big I. gas .....           | 249     |
| 158             | 5.1       | .....                | .....                  | .....             | .....             | .....            | .....       | Big I. gas .....           | 250     |
| 494             | 8         | .....                | .....                  | .....             | .....             | .....            | .....       | Big I. gas .....           | 250     |
| 683             | 8         | 1976                 | .....                  | .....             | .....             | 3030             | 3323        | Big I. gas, light .....    | 251     |
| 470             | ..        | 1750                 | .....                  | .....             | .....             | .....            | 1891        | Big I. gas .....           | 251     |
| 276             | 10        | 1596                 | .....                  | .....             | .....             | .....            | 1779        | Big I. gas .....           | 252     |
| 178             | 11        | 1498                 | .....                  | .....             | .....             | .....            | 1635        | Big I. gas .....           | 252     |
| 285             | 11        | 1529                 | .....                  | .....             | .....             | .....            | 1748        | Big I. gas .....           | 253     |
| 310             | 10        | 1636½                | .....                  | .....             | .....             | .....            | 1777        | Big I. gas .....           | 253     |
| 170             | 7         | 1215                 | .....                  | .....             | .....             | .....            | 1363        | Big I. gas, light .....    | 254     |
| .....           | .....     | 1325                 | .....                  | .....             | .....             | .....            | 1487½       | Big I. gas .....           | 254     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | Big I. gas .....           | 255     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | Big I. gas .....           | 255     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | "Gas" sand gas .....       | 256     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | Big I. gas .....           | 256     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | Big I. gas .....           | 257     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | Big I. gas .....           | 257     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | Big I. gas .....           | 258     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | Big I. gas .....           | 258     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | Big I. gas .....           | 259     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | Big I. gas .....           | 259     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | Big I. gas .....           | 260     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | Big I. gas .....           | 260     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | Big I. gas .....           | 261     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | Big I. gas .....           | 261     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | Big I. and Berea gas ..    | 262     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | Big I. gas, 6th oil .....  | 262     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | 6th oil, B. I. gas .....   | 263     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | B. I. gas .....            | 264     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | B. I. gas .....            | 265     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | B. I. gas .....            | 265     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | B. I. gas .....            | 266     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | B. I. gas .....            | 266     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | B. I. gas, light .....     | 267     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | B. I. gas .....            | 267     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | B. I. gas .....            | 268     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | B. I. gas .....            | 268A    |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | B. I. and 5th gas .....    | 269     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | B. I. gas .....            | 270     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | B. I. gas .....            | 270     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | B. I. gas .....            | 271     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | B. I. gas .....            | 271     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | B. I. gas .....            | 272     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | B. I. gas .....            | 272     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | B. I. gas .....            | 273     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | B. I. gas .....            | 273     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | B. I. gas, light .....     | 274     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | B. I. gas .....            | 274     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | B. I. gas .....            | 275     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | B. I. gas .....            | 275     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | B. I. gas .....            | 276     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | B. I. gas .....            | 276     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | B. I. gas .....            | 277     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | B. I. gas .....            | 277     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | B. I. gas .....            | 278     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | B. I. gas .....            | 278     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | B. I. gas .....            | 279     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | B. I. gas .....            | 279     |

## Summarized Record of

| Map No. | NAME OF WELL                    | Location—District | OWNER               | Elevation A. T. |
|---------|---------------------------------|-------------------|---------------------|-----------------|
| 280     | M. G. Murphy No. 2.....         | Cass .....        | Mississippi .....   | 910B            |
| 281     | Peter Lazzell No. 1.....        | Cass .....        | Mississippi .....   | 1170B           |
| 281A    | C. C. Lazzell No. 1.....        | Cass .....        | Randall .....       | .....           |
| 282     | Mary Garlow No. 1.....          | Cass .....        | McClure .....       | .....           |
| 283     | T. A. and J. F. Keenan No. 1.   | Cass .....        | W. Va. T. & E. .... | 1035B           |
| 284     | Wade & Lazzell.....             | Cass .....        | W. Va. T. & E. .... | .....           |
| 285     | Sam Lazzell No. 1.....          | Cass .....        | Globe .....         | .....           |
| 286     | L. J. Lazzell No. 1.....        | Cass .....        | .....               | 1000B           |
| 287     | Marlon J. Garlow No. 1.....     | Cass .....        | Carnegie .....      | .....           |
| 288     | Marshall Garlow No. 1.....      | Cass .....        | .....               | 1080B           |
| 289     | Ephraim McElroy No. 1.....      | Cass .....        | Maple & Co. ....    | .....           |
| 290     | Sanford Barrackman No. 1..      | Grant .....       | W. Va. T. & E. .... | 1085B           |
| 291     | L. S. Bircher No. 1.....        | Grant .....       | W. Va. T. & E. .... | 1335B           |
| 292     | J. H. Cole coal test No. 2....  | Grant .....       | Consolidation ..... | 1058L           |
| 293     | Eugene Snyder No. 1.....        | Grant .....       | W. Va. T. & E. .... | .....           |
| 294     | J. C. Brand No. 2.....          | Grant .....       | W. Va. T. & E. .... | .....           |
| 295     | Eugene Snyder No. 1.....        | Grant .....       | Hope .....          | .....           |
| 296     | L. B. Brand No. 1.....          | Grant .....       | W. Va. T. & E. .... | .....           |
| 297     | Jehu Davis No. 1.....           | Grant .....       | Hope .....          | 1440B           |
| 298     | Martha A. Miller No. 2.....     | Grant .....       | W. Va. T. & E. .... | 1255B           |
| 299     | J. N. Michael No. 1.....        | Grant .....       | Carnegie .....      | 1215B           |
| 300     | J. N. Michael No. 1998.....     | Grant .....       | Hope .....          | 1305B           |
| 301     | J. N. Michael No. 1.....        | Grant .....       | Hope .....          | 1330B           |
| 302     | J. N. Michael No. 2.....        | Grant .....       | Carnegie .....      | 1175B           |
| 303     | J. N. Michael coal test No. 4   | Grant .....       | Consolidation ..... | 1168L           |
| 304     | J. N. Michael No. 1.....        | Grant .....       | Brock & Courtney .. | 1260B           |
| 305     | J. N. Michael No. 3.....        | Grant .....       | Carnegie .....      | 1265B           |
| 306     | A. Morris (No. 3)?.....         | Grant .....       | W. Va. T. & E. .... | 1280B           |
| 307     | A. Morris No. 2?.....           | Grant .....       | W. Va. T. & E. .... | .....           |
| 308     | J. E. Lynch coal test No. 5...  | Grant .....       | Consolidation ..... | 1068L           |
| 309     | S. C. Stewart coal test No. 8.. | Grant .....       | Consolidation ..... | 1083L           |
| 310     | W. M. Michael coal test.....    | Grant .....       | .....               | 1060B           |
| 311     | Mary Lynch coal test No. 10..   | Grant .....       | Consolidation ..... | 980L            |
| 312     | Benj. J. Miller No. 1.....      | South Run .....   | Consolidation ..... | 951L            |
| 313     | C. M. Arnett coal test No. 7..  | Grant .....       | Consolidation ..... | 999L            |
| 314     | A. C. Barker coal test No. 6..  | Grant .....       | Consolidation ..... | 1005L           |
| 315     | E. W. Brand coal test No. 1..   | Grant .....       | Round Bottom .....  | 1050B           |
| 316     | Jesse Camp No. 1.....           | Grant .....       | McDermott .....     | 925B            |
| 317     | J. W. Holland No. 1.....        | Grant .....       | Mississippi .....   | 875B            |
| 318     | Peninsula Company No. 1...      | Grant .....       | H. C. Greer .....   | 986L            |
| 319     | Yost coal test.....             | Union .....       | H. C. Greer .....   | 935B            |
| 320     | McClaren coal test.....         | Union .....       | Globe .....         | 808L            |
| 320A    | Jos. & David Krepps No. 1..     | Morgan .....      | .....               | .....           |
| 321     | David Rich coal test.....       | Union .....       | H. C. Greer .....   | 806L            |
| 321A    | Wayne Wilson No. 1.....         | Union .....       | Randall .....       | 925B            |
| 322     | Van Voorhis coal test.....      | Union .....       | .....               | 810L            |
| 322A    | D. M. Heard No. 1.....          | Union .....       | Randall .....       | .....           |

## Wells in Monongalia County—Continued.

| PITTSBURGH COAL |           | Big Injun Sand (top) | Thirty Foot Sand (top) | Garden Sand (top) | Fourth Sand (top) | Fifth Sand (top) | Total Depth | PRODUCING SAND AND REMARKS   | Map No. |
|-----------------|-----------|----------------------|------------------------|-------------------|-------------------|------------------|-------------|------------------------------|---------|
| Depth (top)     | Thickness |                      |                        |                   |                   |                  |             |                              |         |
| 12              | 10        | 1335                 |                        |                   |                   |                  | 1490½       | B. I. gas                    | 280     |
| 229             | 13        | 1566                 |                        |                   |                   |                  | 1696        | B. I. gas                    | 281     |
|                 |           |                      |                        |                   |                   |                  |             | B. I. gas                    | 281A    |
|                 |           |                      |                        |                   |                   |                  |             | B. I. gas                    | 282     |
| 117             | 7         | 1452                 |                        |                   |                   |                  | 1592        | B. I. gas                    | 283     |
| 94              | 6         | 1432                 |                        |                   |                   |                  | 1580        | B. I. gas                    | 284     |
| 5               | 10        |                      |                        |                   |                   |                  |             | B. I. gas                    | 285     |
|                 |           |                      |                        |                   |                   |                  |             | B. I. gas                    | 286     |
| 88              | 6         | 1454                 |                        |                   |                   |                  | 1604        | B. I. gas                    | 287     |
|                 |           |                      |                        |                   |                   |                  |             | B. I. gas, light             | 288     |
|                 |           |                      |                        |                   |                   |                  |             | B. I. gas                    | 289     |
| 273             | 8         | 1625                 | 2300                   |                   | 2482              | 2590             | 2785        | B. I. gas, light             | 290     |
| 563             | 9         | 1900                 | 2490                   | 2692              | 2772              | 2862             | 3066        | B. I. and Gnz. gas           | 291     |
| 300             | 14.2      |                      |                        |                   |                   |                  | 315.6       |                              | 292     |
|                 |           |                      |                        |                   |                   |                  |             | B. I. gas, good              | 293     |
| 665             | 9         | 1975                 |                        |                   |                   |                  | 2151        | B. I. gas                    | 294     |
| 437             | 9         | 1750                 | 2465                   |                   | 2734              | 2803             | 2892        | B. I. and 5th gas            | 295     |
| 424             |           | 1762                 | 2535                   | 2573              |                   | 2790             | 2961        | B. I. and Berea gas          | 296     |
| 811             | 10        | 2136                 | 2832                   |                   | 3100              | 3153             | 3227        | B. Dunk, and 5th gas.        | 297     |
| 600             |           | 1899                 |                        | 2800              | 2896              | 2945             | 2980        | B. I., Stray and 5th gas.    | 298     |
| 557             |           | 1864                 |                        |                   | 2897              | 2925             | 2925        | 5th gas                      | 299     |
| 674             | 8         | 1963                 |                        |                   | 2952              | 3004             | 3177        | B. I. and 5th gas            | 300     |
| 684             | 8         | 1990                 | 2675                   |                   | 2965              | 3024             | 3211        | B. I. and 5th gas            | 301     |
| 495             | 5         | 1800                 |                        |                   | 2793              | 2850             | 2887        | 5th gas                      | 302     |
| 498             |           |                      |                        |                   |                   |                  |             |                              | 303     |
|                 |           |                      |                        |                   |                   |                  |             | B. I. and 5th, light gas.    | 304     |
| 730             | 6         | 2040                 |                        |                   |                   |                  | 2172        | B. I. gas                    | 305     |
| 592             | 8         | 1905                 | 2585                   |                   | 2870              | 2943             | 2980        | B. Dunk., B. I. and Gnz. gas | 306     |
| 553             | 8         | 1905                 |                        |                   |                   | 2870             | 2980        | B. I. gas                    | 307     |
| 353             | 8         |                      |                        |                   |                   |                  | 363.5       |                              | 308     |
| 401             | 15.2      |                      |                        |                   |                   |                  | 417.7       |                              | 309     |
| 372             |           |                      |                        |                   |                   |                  |             |                              | 310     |
| 262             | 8         |                      |                        |                   |                   |                  | 272         |                              | 311     |
|                 |           |                      |                        |                   |                   |                  |             | Light gas                    | 312     |
| 223             | 94        |                      |                        |                   |                   |                  | 223.6       |                              | 313     |
|                 |           |                      |                        |                   |                   |                  |             |                              |         |
|                 | 13        |                      |                        |                   |                   |                  | 284         |                              | 314     |
|                 |           |                      |                        |                   |                   |                  |             |                              |         |
| 205             | 16        |                      |                        |                   |                   |                  | 222.2       |                              | 315     |
|                 |           |                      |                        |                   |                   |                  |             | Dry hole                     | 316     |
|                 |           | 1315                 |                        |                   |                   | 2307             | 2616        | Squaw gas, light             | 317     |
|                 |           |                      |                        |                   |                   |                  | (1200)      | B. I.? gas.                  | 318     |
|                 |           |                      |                        |                   |                   |                  | 365         |                              | 319     |
|                 |           |                      |                        |                   |                   |                  | 396         |                              | 320     |
|                 |           | 1012                 |                        |                   | 1820              |                  | 2251        | B. I. gas, light             | 320A    |
|                 |           |                      |                        |                   |                   |                  | 235         |                              | 321     |
|                 |           | 1112                 |                        |                   |                   | 2121             | 2280.5      | B. I. gas, light             | 321A    |
|                 |           |                      |                        |                   |                   |                  | 306½        |                              | 322     |
|                 |           | 1258                 |                        |                   |                   |                  | 1461.5      | B. I. gas, light             | 322A    |

## Summarized Record of

| Map No. | NAME OF WELL                              | Location—<br>District | OWNER                  | Elevation<br>A. T. |
|---------|---|-----------------------|------------------------|--------------------|
| 323     | Van Voorhis & Bailey No. 1.               | Union .....           | W. Va. T. & E. ....    | 810B               |
| 324     | Ed. White No. 1.....                      | Union .....           | Kuntz, Jr., & Co. .... | 840B               |
| 325     | Thos. Manning No. 1.....                  | Union .....           | .....                  | 710B               |
| 326     | Francis Costolo No. 1.....                | Union .....           | Brooks Bros. ....      | 808L               |
| 327     | Francis Costolo No. 1.....                | Union .....           | .....                  | .....              |
| 328     | Mt. Park Land Co. core<br>test No. 1..... | Union .....           | Mt. Park.....          | 787.9L             |
| 329     | Samuel Holt Heirs No. 1....               | Springhill (Pa.)      | .....                  | 895B               |
| 330     | Chess Bros. No. 1.....                    | Union .....           | South Penn .....       | 1250B              |
| 330A    | Ley No. 1.....                            | Union .....           | .....                  | 870B               |
| 331     | Madeira Hotel water well...               | Morgan .....          | Madeira Bros. ....     | 868L               |
| 332     | Snyder No. 1.....                         | Morgan .....          | .....                  | 808L               |
| 332A    | Ed. Wells No. 1.....                      | Morgan .....          | .....                  | 1039L              |
| 333     | Amer. Sheet & Tin Plate<br>Co. No. 3..... | Morgan .....          | Tin Plate .....        | 841L               |
| 334     | Amer. Sheet & Tin Plate<br>Co. No. 5..... | Morgan .....          | Tin Plate .....        | 875L               |
| 335     | Amer. Sheet & Tin Plate<br>Co. No. 2..... | Morgan .....          | Tin Plate .....        | 934L               |
| 336     | Amer. Sheet & Tin Plate<br>Co. No. 4..... | Morgan .....          | Tin Plate .....        | 906L               |
| 337     | Gamble coal test.....                     | Morgan .....          | S. B. Elkins .....     | 880L               |
| 338     | Hagedorn & Sons No. 1.....                | Morgan .....          | Bradley et al. ....    | .....              |
| 339     | Maiden Spring Run well...                 | Morgan .....          | Bradley et al. ....    | .....              |
| 340     | Edmund Shisler No. 1.....                 | Morgan .....          | Kuntz, Jr., & Co. .... | .....              |
| 341     | F. M. Johnson No. 1.....                  | Clinton .....         | .....                  | 835B               |
| 342     | Furnace tract No. 1.....                  | Clinton .....         | .....                  | 1135B              |
| 342A    | Minor Tennant No. 1.....                  | Clinton .....         | Hope .....             | .....              |
| 343     | Wm. E. Watson No. 1.....                  | Clinton .....         | .....                  | 1100B              |
| 344     | Rose Watson No. 1907.....                 | Clinton .....         | Phila .....            | 970B               |

**Wells in Monongalia County—Continued.**

| PITTSBURGH COAL |           | Big Injan Sand (top) | Thirty Foot Sand (top) | Gordon Sand (top) | Fourth Sand (top) | Fifth Sand (top) | Total Depth | PRODUCING SAND AND REMARKS | Map No. |
|-----------------|-----------|----------------------|------------------------|-------------------|-------------------|------------------|-------------|----------------------------|---------|
| Depth (top)     | Thickness |                      |                        |                   |                   |                  |             |                            |         |
|                 |           | 1100                 |                        |                   | 2077              | 2120             | 2607        | B. I. gas .....            | 323     |
|                 |           |                      |                        |                   |                   |                  |             | Dry hole .....             | 324     |
|                 |           |                      |                        |                   |                   |                  |             | Gas show, light .....      | 325     |
|                 |           |                      |                        |                   |                   |                  | 2504        | B. I. gas and oil show ..  | 326     |
|                 |           |                      |                        |                   |                   |                  | 600         | Salt, oil show .....       | 327     |
|                 |           |                      |                        |                   |                   |                  | 100.3       | .....                      | 328     |
|                 |           |                      |                        |                   |                   |                  | 500         | Salt, light gas .....      | 329     |
|                 |           |                      |                        |                   |                   |                  | 2200        | Dry hole .....             | 330     |
|                 |           | 270                  |                        |                   |                   |                  | 970         | Dry hole .....             | 330A    |
|                 |           |                      |                        |                   |                   |                  | 620         | Water well .....           | 331     |
|                 |           | 910                  |                        |                   |                   |                  | 2267½       | B. I. and Berea gas .....  | 332     |
|                 |           |                      |                        |                   |                   |                  | 800         | Dry hole .....             | 332A    |
|                 |           |                      |                        |                   |                   |                  | 371         | .....                      | 333     |
|                 |           |                      |                        |                   |                   |                  | 427½        | .....                      | 334     |
|                 |           |                      |                        |                   |                   |                  | 327½        | .....                      | 335     |
|                 |           |                      |                        |                   |                   |                  | 402½        | .....                      | 336     |
|                 |           |                      |                        |                   |                   |                  | 403.2       | .....                      | 337     |
|                 |           |                      |                        |                   |                   |                  | 700-800     | B. I. gas? .....           | 338     |
|                 |           |                      |                        |                   |                   |                  | 700-800     | Dry hole .....             | 339     |
|                 |           | 890                  |                        |                   |                   |                  | 2400        | Dry hole .....             | 340     |
|                 |           | 850                  |                        | 1496              |                   |                  | 2280        | Dry hole .....             | 341     |
|                 |           |                      |                        |                   |                   |                  | 300         | Dry hole .....             | 342     |
|                 |           |                      |                        |                   |                   |                  |             | Dry hole .....             | 342A    |
|                 |           |                      |                        |                   |                   |                  |             | Dry hole .....             | 343     |
|                 |           | 905                  |                        |                   |                   | 2046             | 2413        | 6th gas, light .....       | 344     |

In the elevation column the letter "B" indicates that the elevation of the well mouth was obtained with aneroid checked with nearby U. S. G. Survey spirit level elevations; the letter "L", with spirit level, the same being expressed in feet above tide. Depths to the Pittsburgh coal and the several sands are also expressed in feet.

Under the column headed "Producing Sand," the following abbreviations are used:

|               |                    |
|---------------|--------------------|
| I. C. R. .... | First Cow Run.     |
| B. Dunk ..... | Big Dunkard.       |
| Gas Ss. ....  | Gas Sand.          |
| II C. R. .... | Second Cow Run.    |
| Max. ....     | Maxton.            |
| Knr. ....     | Keener.            |
| Big I. ....   | Big Injun.         |
| Berea .....   | Berea Grit.        |
| Gnz. ....     | Gantz.             |
| 50-ft. ....   | Fifty-foot.        |
| 30-ft. ....   | Thirty-foot.       |
| Stray .....   | Gordon Stray.      |
| Gord. ....    | Gordon.            |
| 4th. ....     | Fourth.            |
| 5th. ....     | Fifth or McDonald. |
| 6th. ....     | Sixth or Bayard.   |
| Eliz. ....    | Elizabeth.         |

The accompanying table furnishes a means of ready reference as to the ownership and elevation of the several wells, along with the depth and thickness of the Pittsburgh coal, the depth to five important oil and gas horizons, and the name of the producing sands at most of the wells, but it is essential that the complete logs of a number of these borings be published, not only to preserve them from loss, but for the fund of information they contain as to other sands, as well as the presence or absence of minable coals. The accurate location of any tabulated well is readily determined from its serial or map number, published in the above table, on Map II and with the heading in parenthesis when the complete record is given.

Oil or gas in paying quantities have been produced in every district of Monongalia county west of the Monongahela river, but on the east side of the latter stream only one small paying gas well, located at Van Voorhis, has yet been found. The logs of a number of these wells along with a discussion of the several oil and gas fields and their relation to geologic structures will now be given by magisterial districts. The names of the sands and other formations inserted in parenthesis are corrections by the writer.

### *Battelle District.*

Battelle district occupies the western end of Monongalia county, and adjoins Greene county, Pa., and Wetzel and Marion counties, W. Va. A glance at the structure contours on Map II will show that it is traversed in a northeast-southwest direction by three folds; viz., the Robinson and Waynesburg synclines, and the Amity anticline; and that its strata are very much warped, giving ideal conditions for the oil and gas pools found therein. In the northwestern corner of the district is found a pool of 8 oil wells in the Fourth sand along the axis of the Robinson Basin, being an extension to the northeast of the Hixenbaugh field of Wetzel county. This pool conforms ideally to the anticlinal theory as developed by I. C. White<sup>4</sup> in regard to the influence of structure on the seg-

4. Vol. I(a), W. Va. Geol. Survey, pp. 54-59; 1904.



regation of oil and gas into commercial pools, since this sand like all others below the Big Injun in this portion of the State is non-water bearing, thus permitting the oil which is heavier than gas to drop down along its horizon into the low portion of the trough. The same applies roughly to the great oil pools along the eastern border of Battelle at Bula, Crossroads and St. Leo.

On entering the district from Greene county, near Hero, the axis of the Amity anticline dips rapidly southward to the intersection of the axes of the Robinson and Waynesburg synclines, but along or near its crest there occur 25 to 30 gas wells. In the southeastern corner of the district there occurs another large oil pool in the Big Injun, Fourth and Bayard sands.

Taking up the Fourth sand pool first mentioned, the following record of a well from this locality gives the oil horizon and other data of interest:

### John E. Snyder No. 1 Well Record (1).

Battelle district, 1.2 miles N 30° W of St. Cloud. Authority Cochran & Funk. Completed May 20, 1908.

| (Elevation, 1425' B-A. T.)   | Thickness. Total. |       |
|--|-------------------|-------|
|  | Feet.             | Feet. |
| Unrecorded .....   | 1095              | 1095  |
| Mapletown (Sewickley) coal.....  | 5                 | 1100  |
| Unrecorded .....   | 100               | 1200  |
| Pittsburgh coal.....   | 9                 | 1209  |
| Unrecorded .....   | 391               | 1600  |
| Little Dunkard sand.....   | 40                | 1640  |
| Unrecorded .....   | 43                | 1683  |
| Big Dunkard sand.....  | 92                | 1775  |
| Unrecorded .....   | 110               | 1885  |
| Gas sand .....   | 55                | 1940  |
| Unrecorded .....   | 15                | 1955  |
| Salt sand .....  | 260               | 2215  |
| Unrecorded .....   | 120               | 2335  |
| Maxton sand.....   | 40                | 2375  |
| Unrecorded .....   | 10                | 2385  |
| Big Lime .....   | 65                | 2450  |
| Big Injun sand (gas, 2540'-2550').....                                 | 240               | 2690  |
| Unrecorded .....   | 120               | 2810  |
| Thirty-foot sand.....  | 235               | 3045  |
| Unrecorded .....   | 105               | 3150  |
| Fifty-foot sand.....   | 80                | 3230  |
| Unrecorded .....   | 20                | 3250  |
| Gordon Stray sand.....   | 28                | 3278  |
| Unrecorded .....   | 60                | 3338  |
| Sand, (Fourth) (gas, 3381'; oil, 3382') and unrecorded to bottom ..... | 52                | 3390  |

The Pittsburgh coal—Fourth sand interval is slightly less here than in the St. Leo region, owing to the northwestward thinning of the intervening strata. The log of the Sarah E. Anderson No. 1 well, published in connection with the Burton (Wetzel county) section on pages 110-113 of the Marshall-Wetzel-Tyler Report of the State Survey, exhibits the true correlation of the Gordon group of sands for this region.

The following is the record of a dry hole drilled 0.3 mile northward just across the State line in Pennsylvania. It illustrates the patchy nature characteristic of the Fourth sand along this synclinal basin both northeastward in Pennsylvania and southwestward in Wetzel county, since the latter is dry while a very small showing of oil occurs in the Gordon:

#### Barnett Renner No. 1 Well Record (2).

Springhill Township, Greene county, Pa., 0.9 mile southeast of Garrison. Authority, S. W. Meals.

| (Elevation, 1175' B-A. T.)                           | Thickness. |             |
|--|------------|-------------|
|  | Feet.      | Total Feet. |
| Unrecorded .....                                     | 951        | 951         |
| <b>Pittsburgh coal</b> .....                         | 7          | 958         |
| Unrecorded .....                                     | 393        | 1351        |
| Little Dunkard sand.....                             | 35         | 1386        |
| Unrecorded .....                                     | 367        | 1753        |
| Salt sand.....                                       | 107        | 1860        |
| Unrecorded .....                                     | 216        | 2076        |
| Maxton sand.....                                     | 40         | 2116        |
| Unrecorded .....                                     | 11         | 2127        |
| Big Lime.....  | 77         | 2204        |
| Big Injun sand.....                                  | 213        | 2417        |
| Unrecorded .....                                     | 334        | 2751        |
| Sands, Gantz and Fifty-foot.....                     | 67         | 2818        |
| Unrecorded .....                                     | 75         | 2893        |
| Thirty-foot sand.....                                | 25         | 2918        |
| Unrecorded .....                                     | 57         | 2975        |
| Gordon Stray sand.....                               | 25         | 3000        |
| Unrecorded .....                                     | 27         | 3027        |
| <b>Gordon sand</b> (very small oil show, 3043')..... | 25         | 3052        |
| Unrecorded .....                                     | 23         | 3075        |
| Fourth sand.....                                     | 80         | 3155        |
| Unrecorded .....                                     | 18         | 3173        |
| Fifth sand.....                                      | 17         | 3190        |
| Unrecorded to bottom.....                            | 18         | 3208        |

"A real dry one, no oil or gas in any sand, except the small show above mentioned in the Gordon sand."

The following is the record of a well in the Fourth sand oil pool:

**Barney Renner No. 2165 Well Record (37).**

Battelle district, 0.3 mile southwest of St. Cloud. Authority, Philadelphia Company.

| (Elevation, 1365' L-A. T.)                      | Thickness. Total. |       |
|---|-------------------|-------|
|   | Feet.             | Feet. |
| Unrecorded .....                                | 1044              | 1044  |
| Mapletown (Sewickley) coal, and unrecorded..... | 107               | 1151  |
| Pittsburgh coal and unrecorded.....             | 1175              | 2326  |
| Big Lime.....                                   | 95                | 2421  |
| Big Injun sand.....                             | 224               | 2645  |
| Unrecorded .....                                | 545               | 3190  |
| Sand, (Gordon) (gas, 3195').....                | 66                | 3256  |
| Unrecorded .....                                | 29                | 3285  |
| Sand, (Fourth) (oil, 3325').....                | 43                | 3328  |
| Unrecorded to bottom.....                       | 3                 | 3331  |

The **Eli White No. 1 well (5)**, located about half way up the western slope of the Amity anticline, 1.6 miles northeast of St. Cloud, and drilled during 1889 and 1890, was probably the first deep well to be bored in the district. A strong flow of gas was encountered at 88 feet in the Big Injun sand, and also in the Gantz. The boring attained a depth of only 2090 feet below the Pittsburgh coal; hence, did not quite reach the Fourth sand. At that time a gas well in this region was considered the same as a dry hole, so it was plugged, the casing partly pulled and the well abandoned.

The **Kinsey Renner Heirs No 1 well (3)**, located just across the State line in the edge of Springhill township, 1.5 miles due north of St. Cloud, was drilled to a depth of 3084 feet below the top of the Pittsburgh coal without getting either oil or gas in paying quantities. A showing of gas was encountered in the Big Injun and in a sand shell—probably the Seventh or Elizabeth sand—at a depth of 2430'—2529' below the top of the Pittsburgh coal. A 3 to 4 bbl. showing of oil occurred in the Fourth sand at a depth of 3085 feet.

The log of the **Jas. L. White No. 1 well (7)**, 1 mile north-east of St. Cloud, is published in connection with the St. Cloud section, page 92.

In addition to the brief logs as given in the table of wells for Monongalia county, the much more complete records of the following in Battelle district except No. 18 are published

on the pages indicated of Vol. I(A) and Vol. I of the State Survey reports:

| Map No. | Name of Well.              | Location                                | Page. Vol.1(A) |
|---------|----------------------------|---|----------------|
| 4       | S. L. S. Spragg No. 1..... | 0.5 mile N. E. of St. Cloud .....       | 150            |
| 16      | William Porter No. 1.....  | 1.7 mile N. W. of Wise                  | 149            |
| 18      | Jacob Simpson No. 1.....   | 0.1 mile E. of Jollytown.               | 126            |
| 24      | James Hagan No. 1.....     | 0.7 mile S. W. of Wise..                | 149            |
| 34      | R. S. Clovis No. 1.....    | 1.6 mile N. W. of Wadestown .....       | 143            |
| 54      | Haught Heirs No. 1.....    | 0.6 mile N. W. of St. Leo               | 148            |
| 66      | Rufus Bell No. 1.....      | 0.8 mile S. E. of Wise...               | 143            |
| 68      | Rufus Bell No. 2.....      | 1 mile S. E. of Wise..                  | 144            |
| 70      | Milo Strosnider No. 1..... | 1 mile S. E. of Wise..                  | 144            |
| 79      | Sarah E. Eddy No. 1.....   | 0.4 mile N. W. of Crossroads .....      | 143            |
| 91      | Ewing Heirs No. 1.....     | 2.1 mile S., 10° E. of Wadestown .....  | 145            |
| 102     | J. M. Hall No. 1.....      | 0.1 mile S. W. of St. Leo               | 147            |
| 110     | Anna Harvey No. 1.....     | 1.7 mile N., 70° E. of Galletin .....   | 137            |
| 31      | Alonzo Edwards No. 1.....  | 0.5 mile N. E. of Wadestown .....       | Vol. I. 230    |
| 90      | Samuel Eakin No. 1.....    | 2.1 miles S., 10° E. of Wadestown ..... | 232            |

No. 4 had a gas show in the Big Injun and an oil show in Fourth. wrongly named Gordon, but was abandoned as dry hole.

No. 16 had gas show in Bayard, but was abandoned as dry hole

No. 18 was a heavy gasser in Big Injun with rock pressure of 700 pounds.

No. 24 was a light gasser in Gantz, but abandoned as non-paying well.

No. 34, light gas in Big Injun; drilled to 2622' below Pittsburgh coal; no Bayard or Elizabeth; abandoned as dry hole.

No. 54 had oil shows in Fifty-foot and Bayard, but abandoned as dry hole.

No. 66 was a Fourth sand oil producer.

No. 68 was a Fourth said oil producer.

No. 79 had gas show in Big Injun, was a heavy gasser in Gordon and had an initial production of 360 bbls. of oil daily from Fourth sand.

No. 91 was a heavy gasser in Gantz and a good Gordon oil producer.

No. 102 was a fair Gordon oil producer.

No. 110 was a 2200 bbl. daily oil producer from the Fourth sand.

No. 31 was a gasser, Big Injun, Gantz, Fifty-foot and Fifth.

No. 90 was a strong gasser in Gantz and a fair oil producer in Gordon.

The following records of gas wells scattered along the crest and western slope of the Amity anticline give valuable

data as to the coals, gas horizons, volume and rock pressure of the borings. The principal gas horizons are the Big Injun, Fifty-foot, Thirty-foot, Gordon, Fourth and Fifth sands.

### Fred H. Hennen No. 1 Well Record (6).

Battelle district, 1 mile northwest of Maple. Authority, Carnegie Natural Gas Co. Completed Nov. 28, 1906.

| (Elevation, 1110' B-A. T.)                | Thickness. Total. |       |
|---|-------------------|-------|
|   | Feet.             | Feet. |
| Unrecorded .....                          | 855               | 855   |
| Pittsburgh coal and unrecorded.....       | 1260              | 2115  |
| Big Injun sand.....                       | 285               | 2400  |
| Unrecorded .....                          | 420               | 2820  |
| Sand, Fifty-foot (Little Gas, 2823')..... | 28                | 2848  |
| Unrecorded .....                          | 30                | 2878  |
| Sand, Thirty-foot (gas, 2891').....       | 25                | 2903  |
| Unrecorded .....                          | 6                 | 2909  |
| Gordon Stray.....                         | 25                | 2934  |
| Unrecorded .....                          | 40                | 2974  |
| Sand, Gordon (little gas, 2975').....     | 26                | 3000  |
| Unrecorded .....                          | 25                | 3025  |
| Fourth sand.....                          | 50                | 3075  |
| Unrecorded .....                          | 34                | 3109  |
| Fifth sand.....                           | 21                | 3130  |
| Unrecorded .....                          | 25                | 3155  |
| Sand .....                                | 15                | 3170  |
| Unrecorded to bottom.....                 | 41                | 3211  |

10" casing, 130'; 8¼" casing, 1295"; 6½" casing, 2070'; and 4" tubing, 2159'.

This well is still producing gas in February, 1913.

### John G. White No. 1 Well Record (8).

Battelle district, 0.7 mile west of Maple. Authority, Carnegie Natural Gas Company. Completed April 8, 1910.

| (Elevation, 1150' B-A. T.)      | Thickness. Total. |       |
|---------------------------------|-------------------|-------|
|                                 | Feet.             | Feet. |
| Unrecorded .....                | 540               | 540   |
| Waynesburg coal.....            | 5                 | 545   |
| Unrecorded .....                | 235               | 780   |
| Mapletown coal.....             | 4                 | 784   |
| Unrecorded .....                | 96                | 880   |
| Pittsburgh coal.....            | 8                 | 888   |
| Unrecorded .....                | 1293              | 2181  |
| Big Injun sand (gas 2259')..... | 225               | 2406  |
| Unrecorded .....                | 602               | 3008  |
| Gordon Stray sand.....          | 15                | 3023  |
| Unrecorded .....                | 32                | 3055  |
| Gordon sand .....               | 62                | 3117  |
| Unrecorded .....                | 33                | 3150  |
| Fourth sand .....               | 14                | 3164  |

|                           | Thickness. | Total. |
|---------------------------|------------|--------|
|                           | Feet.      | Feet.  |
| Unrecorded .....          | 17         | 3181   |
| Fifth sand .....          | 45         | 3226   |
| Unrecorded to bottom..... | 82         | 3308   |
| Abandoned as dry hole.    |            |        |

### Simon L. White No. 1 Well Record (9).

Battelle district, at Maple. Authority, Philadelphia Company.

|   | Thickness. | Total. |
|---|------------|--------|
| (Elevation, 1130' B-A. T.)                      | Feet.      | Feet.  |
| Unrecorded .....                                | 755        | 755    |
| Mapletown (Sewickley) coal, and unrecorded..... | 90         | 845    |
| Pittsburgh coal and unrecorded.....             | 770        | 1615   |
| Salt sand.....                                  | 207        | 1822   |
| Unrecorded .....                                | 309        | 2131   |
| Big Injun sand.....                             | 239        | 2370   |
| Unrecorded .....                                | 650        | 3020   |
| Sand, (Gordon).....                             | 40         | 3060   |
| Unrecorded .....                                | 20         | 3080   |
| Sand, (Fourth).....                             | 36         | 3116   |
| Unrecorded .....                                | 20         | 3136   |
| Sand, (Fifth) (gas pay, 3145'-3147').....       | 27         | 3163   |

This well did not make sufficient gas to justify connection with the company's pipe line.

### Thomas White No. 1 Well Record (10).

Battelle district, 0.4 mile northeast of Maple. Authority, Manufacturers Light & Heat Company. Completed January 14, 1905.

|                                 | Thickness. | Total. |
|---------------------------------|------------|--------|
| (Elevation, 1065' B-A. T.)      | Feet.      | Feet.  |
| Conductor .....                 | 12         | 12     |
| Unrecorded .....                | 438        | 450    |
| Waynesburg coal.....            | 6          | 456    |
| Unrecorded .....                | 238        | 694    |
| Mapletown (Sewickley) coal..... | 5          | 699    |
| Unrecorded .....                | 86         | 785    |
| Pittsburgh coal.....            | 8          | 793    |
| Unrecorded .....                | 232        | 1025   |
| Murphy sand .....               | 20         | 1045   |
| Unrecorded .....                | 165        | 1200   |
| Little Dunkard sand.....        | 30         | 1230   |
| Unrecorded .....                | 80         | 1310   |
| Big Dunkard sand.....           | 35         | 1345   |
| Unrecorded .....                | 95         | 1440   |
| (Gas sand) .....                | 120        | 1560   |
| Unrecorded .....                | 30         | 1590   |
| Sand, (II Cow Run).....         | 50         | 1640   |
| Unrecorded .....                | 25         | 1665   |
| Salt sand (water, 1676').....   | 155        | 1820   |
| Unrecorded .....                | 150        | 1970   |

|  | Thickness.<br>Feet. | Total.<br>Feet. |
|--|---------------------|-----------------|
| Pencil cave.....   | 5                   | 1975            |
| Big Lime .....   | 75                  | 2050            |
| Big Injun sand (gas, 2060' and 2078' and unrecorded to<br>bottom .....   | 190                 | 2240            |
| 13" casing, 57'; 10" casing, 1181'; 8 $\frac{1}{4}$ " casing, 1744'; 6 $\frac{1}{2}$ " casing,<br>1995'.<br>"First minute pressure in 4" tubing, 138 lbs.; rock pressure,<br>700 lbs." |                     |                 |

The well starts flush with the crop of the Dunkard coal, and is still making gas in paying quantity from the Big Injun.

### J. P. Hagan No. 2 Well Record (12).

Gilmore township, Greene county, Pa., 0.9 mile west of Hero.  
Authority, Porter Daubenspeck, a driller on well.

| (Elevation, 1095' B-A. T.)             | Thickness.<br>Feet. | Total.<br>Feet. |
|--|---------------------|-----------------|
| Clay .....                             | 15                  | 15              |
| Lime, white and hard (water, 50')..... | 155                 | 170             |
| Red rock .....                         | 35                  | 205             |
| Slate and lime, white and broken.....  | 75                  | 280             |
| Lime, white and hard.....              | 30                  | 310             |
| Slate, dark, soft.....                 | 30                  | 340             |
| Lime, white and hard.....              | 25                  | 365             |
| Slate, white and soft.....             | 15                  | 380             |
| Lime, white and hard.....              | 75                  | 455             |
| Sand, white and hard, Waynesburg.....  | 25                  | 480             |
| Coal, Waynesburg.....                  | 3                   | 483             |
| Slate, white.....                      | 57                  | 540             |
| Sand, white.....                       | 15                  | 555             |
| Slate, dark.....                       | 60                  | 615             |
| Lime, white and hard.....              | 97                  | 712             |
| Coal, Mapletown (Sewickley).....       | 4                   | 716             |
| Lime, dark, hard.....                  | 84                  | 800             |
| Slate, soft.....                       | 5                   | 805             |
| Coal, Pittsburgh.....                  | 8                   | 813             |
| Slate, dark.....                       | 25                  | 838             |
| Sand, dark.....                        | 7                   | 845             |
| Slate.....                             | 30                  | 875             |
| Lime, white and hard.....              | 25                  | 900             |
| Red rock.....                          | 5                   | 905             |
| Slate.....                             | 45                  | 950             |
| Red rock.....                          | 20                  | 970             |
| Sand, (Minshall).....                  | 20                  | 990             |
| Red rock.....                          | 45                  | 1035            |
| Slate.....                             | 35                  | 1070            |
| Red rock.....                          | 50                  | 1120            |
| Slate.....                             | 20                  | 1140            |
| Lime.....                              | 20                  | 1160            |
| Slate.....                             | 37                  | 1197            |
| Sand, hard, Little Dunkard.....        | 70                  | 1267            |
| Slate.....                             | 38                  | 1305            |

|  | Thickness. | Total. |
|--|------------|--------|
|  | Feet.      | Feet.  |
| Lime .....   | 26         | 1331   |
| Sand, white and hard, Big Dunkard.....   | 79         | 1410   |
| Slate, dark.....   | 10         | 1420   |
| Sand, white, hard.....   | 10         | 1430   |
| Slate .....  | 25         | 1455   |
| Gas sand, white and hard.....  | 125        | 1580   |
| Slate, black.....  | 25         | 1605   |
| Sand (M Cow Run and Salt) (water, 1710').....  | 130        | 1735   |
| Lime, dark.....  | 10         | 1745   |
| Slate, dark.....   | 90         | 1835   |
| Sand, white and hard.....  | 10         | 1845   |
| Slate .....  | 15         | 1860   |
| Red rock .....   | 120        | 1980   |
| Lime, white and hard.....  | 10         | 1990   |
| Slate .....  | 25         | 2015   |
| Sand, white and hard.....  | 8          | 2023   |
| Slate .....  | 7          | 2030   |
| Big Lime (Greenbrier Limestone).....   | 60         | 2090   |
| Big Injun sand, white and hard, (gas, 2165').....  | 260        | 2350   |
| Slate .....  | 30         | 2380   |
| Lime .....   | 25         | 2405   |
| Sand, dark and hard (Squaw).....   | 30         | 2435   |
| Slate and shells.....  | 225        | 2660   |
| Sand, white and hard (Berea).....  | 25         | 2685   |
| Slate, shelly.....   | 110        | 2795   |
| Fifty-foot sand (gas, 2811').....  | 28         | 2823   |
| Slate .....  | 8          | 2831   |
| Sand, hard and white .....   | 16         | 2847   |
| Slate .....  | 5          | 2852   |
| Sand, white and hard (Thirty-foot).....  | 60         | 2912   |
| Red rock.....  | 3          | 2915   |
| Slate and shells, white and close.....   | 45         | 2960   |
| Stray sand, white and hard.....  | 20         | 2980   |
| Slate, shelly .....  | 25         | 3005   |
| Gordon sand.....   |            |        |
| 10" casing, 347' 6"; 8 $\frac{1}{4}$ " casing, 1206' 8"; 6 $\frac{5}{8}$ " casing, 1743'; 5" casing, 2142' 3". |            |        |

This well was abandoned on account of fishing job and a new hole drilled nearby which proved dry.

### J. P. Hagan No. 1 Well Record (13).

Gillmore township, Greene county, Pa., 0.6 mile west of Hero. Authority, Philadelphia Company. Completed Aug. 15, 1905.

|  | Thickness. | Total. |
|--|------------|--------|
|  | Feet.      | Feet.  |
| (Elevation, 1040' B-A. T.)                     |            |        |
| Unrecorded .....                               | 642        | 642    |
| Mapletown (Sewickley) coal and unrecorded..... | 98         | 740    |
| Pittsburgh coal.....                           | 7          | 747    |
| Unrecorded .....                               | 1274       | 2021   |
| Big Injun sand (gas, 2102').....               | 271        | 2292   |
| Unrecorded .....                               | 533        | 2825   |



|  | Thickness.<br>Feet.           | Total.<br>Feet. |
|--|-------------------------------|-----------------|
| Sand, (Stray).....                               | 25                            | 2850            |
| Unrecorded .....                                 | 100                           | 2950            |
| Fourth sand.....                                 | 30                            | 2980            |
| Unrecorded .....                                 | 78                            | 3058            |
| Fifth sand (gas, 3058').....                     | 32                            | 3090            |
| Unrecorded .....                                 | 45                            | 3135            |
| Bayard sand.....                                 | 10                            | 3145            |
| Unrecorded to bottom.....                        | 198                           | 3343            |
| First pressure test in 5 $\frac{3}{8}$ " casing: |                               |                 |
| 2nd minute, 2 $\frac{1}{2}$ lbs.                 | 30th minute, 95lbs.           |                 |
| 5th minute, 15 lbs.                              | 45th minute, 135 lbs.         |                 |
| 10th minute, 35 lbs.                             | Rock pressure in 3 hours, 600 |                 |
| 20th minute, 65 lbs.                             | lbs.                          |                 |

The last two wells are a few hundred feet over the State line in the edge of Pennsylvania, the latter starting 9 feet above the Jollytown coal which crops here in the bed of Dunkard creek.

### Elijah C. Clovis No. 1 Well Record (35).

Battelle district, 1.1 miles east of St. Cloud. Authority, Manufacturers Light & Heat Company. Completed July 29, 1905.

| (Elevation, 1165' B-A. T.)  | Thickness.<br>Feet. | Total.<br>Feet. |
|---|---------------------|-----------------|
| Conductor .....   | 12                  | 12              |
| Unrecorded .....  | 573                 | 585             |
| Waynesburg coal.....  | 3                   | 588             |
| Unrecorded .....  | 237                 | 825             |
| Mapletown (Sewickley) coal.....   | 7                   | 832             |
| Unrecorded .....  | 88                  | 920             |
| Pittsburgh coal.....  | 8                   | 928             |
| Unrecorded .....  | 152                 | 1080            |
| Sand (Minshall).....  | 10                  | 1090            |
| Unrecorded .....  | 170                 | 1260            |
| Sand .....  | 10                  | 1270            |
| Unrecorded .....  | 40                  | 1310            |
| Sand .....  | 50                  | 1360            |
| Unrecorded .....  | 40                  | 1400            |
| Big Dunkard sand (gas, 1400').....  | 40                  | 1440            |
| Unrecorded .....  | 145                 | 1585            |
| Gas sand .....  | 100                 | 1685            |
| Unrecorded .....  | 45                  | 1730            |
| Salt sand (water, 1835'; break, 1850'-1880').....                                   | 160                 | 1890            |
| Unrecorded .....  | 120                 | 2010            |
| Maxton sand .....   | 25                  | 2035            |
| Red rock .....  | 20                  | 2055            |
| Unrecorded .....  | 75                  | 2130            |
| Big Lime (very hard).....   | 78                  | 2208            |
| Big Injun sand (gas, 2219').....  | 238                 | 2446            |
| Unrecorded .....  | 429                 | 2875            |
| Fifty-foot sand (gas 2878') to bottom.....  | 61                  | 2936            |
| 10" casing, 400'; 8 $\frac{1}{4}$ " casing, 1354'; 6 $\frac{1}{2}$ " casing, 1912'. |                     |                 |
| "Pressure test in 4" tubing; first minute, 110 lbs.; rock pressure, 680 lbs.        |                     |                 |

The above well is still producing gas in the pipe lines.

**Nancy Hostutler No. 1 Well Record (38).**

Battelle district, 0.7 mile southeast of St. Cloud. Authority, Manufacturers Light & Heat Company. Completed Nov. 8, 1905.

| (Elevation, 1200' B-A. T.)               | Thickness. | Total. |
|--|------------|--------|
|  | Feet.      | Feet.  |
| Conductor .....                          | 13         | 13     |
| Unrecorded .....                         | 452        | 465    |
| Sand .....                               | 65         | 530    |
| Unrecorded .....                         | 115        | 645    |
| Waynesburg coal.....                     | 5          | 650    |
| Unrecorded .....                         | 100        | 750    |
| Sand .....                               | 40         | 790    |
| Lime .....                               | 90         | 880    |
| Unrecorded .....                         | 10         | 890    |
| Mapletown (Sewickley) coal.....          | 5          | 895    |
| Unrecorded .....                         | 100        | 995    |
| Pittsburgh coal.....                     | 5          | 1000   |
| Unrecorded .....                         | 340        | 1340   |
| Little Dunkard sand.....                 | 15         | 1355   |
| Unrecorded .....                         | 155        | 1500   |
| Big Dunkard sand.....                    | 80         | 1580   |
| Unrecorded .....                         | 100        | 1680   |
| Gas sand .....                           | 60         | 1740   |
| Unrecorded .....                         | 25         | 1765   |
| Sand (II Cow Run).....                   | 35         | 1800   |
| Unrecorded .....                         | 15         | 1815   |
| Salt sand (no water).....                | 90         | 1905   |
| Unrecorded .....                         | 145        | 2050   |
| Red rock.....                            | 45         | 2095   |
| Maxton sand.....                         | 45         | 2140   |
| Unrecorded .....                         | 45         | 2195   |
| Pencil cave.....                         | 10         | 2205   |
| Big Lime.....                            | 63         | 2268   |
| Big Injun sand.....                      | 223        | 2491   |
| Unrecorded .....                         | 319        | 2810   |
| Sand (Berea) .....                       | 25         | 2835   |
| Unrecorded .....                         | 109        | 2944   |
| Gantz sand.....                          | 10         | 2954   |
| Unrecorded .....                         | 16         | 2970   |
| Fifty-foot sand (little gas, 3046')..... | 87         | 3057   |
| Unrecorded .....                         | 83         | 3140   |
| Gordon sand .....                        | 47         | 3187   |
| Unrecorded .....                         | 37         | 3224   |
| Fourth sand.....                         | 10         | 3234   |
| Unrecorded .....                         | 31         | 3265   |
| Fifth sand.....                          | 15         | 3280   |
| Unrecorded .....                         | 180        | 3420   |
| Bayard sand.....                         | 3          | 3423   |
| Unrecorded to bottom.....                | 164        | 3587   |

10" casing, 481'; 8 $\frac{1}{4}$ " casing, 1418'; 6 $\frac{3}{8}$ " casing, 2223'.

The above well reached a depth of 2587 below the Pittsburgh coal and reports no Elizabeth sand, the same being true of the following well which penetrated the strata to a depth of 2582 feet below the Pittsburgh coal.

## Nancy Johnson No. 1 Well Record (40).

Battelle district, 1.1 miles southeast of St. Cloud. Authority, Manufacturers Light & Heat Company. Completed Feb. 10, 1907.

| (Elevation, 1095' B-A. T.)                 | Thickness. Total. |       |
|--|-------------------|-------|
|  | Feet.             | Feet. |
| Unrecorded .....                           | 756               | 756   |
| Mapletown (Sewickley) coal.....            | 4                 | 760   |
| Unrecorded .....                           | 107               | 867   |
| Pittsburgh coal.....                       | 5                 | 872   |
| Unrecorded .....                           | 390               | 1262  |
| Little Dunkard sand.....                   | 60                | 1322  |
| Unrecorded .....                           | 68                | 1390  |
| Big Dunkard sand.....                      | 20                | 1410  |
| Unrecorded .....                           | 131               | 1541  |
| Gas sand .....                             | 69                | 1610  |
| Unrecorded .....                           | 60                | 1670  |
| Salt sand .....                            | 80                | 1750  |
| Unrecorded .....                           | 225               | 1975  |
| Maxton sand.....                           | 30                | 2005  |
| Unrecorded .....                           | 52                | 2057  |
| Big Lime .....                             | 75                | 2132  |
| Big Injun sand (water, 2257').....         | 228               | 2360  |
| Unrecorded .....                           | 444               | 2804  |
| Fifty-foot sand (gas, 2814').....          | 44                | 2848  |
| Unrecorded .....                           | 10                | 2858  |
| Sand, Thirty-foot.....                     | 22                | 2880  |
| Unrecorded .....                           | 29                | 2909  |
| Gordon Stray sand.....                     | 21                | 2930  |
| Unrecorded .....                           | 25                | 2955  |
| Gordon sand.....                           | 30                | 2985  |
| Unrecorded .....                           | 30                | 3015  |
| Fourth sand .....                          | 40                | 3055  |
| Unrecorded .....                           | 20                | 3075  |
| Fifth sand.....                            | 25                | 3100  |
| Unrecorded to bottom (no Bayard sand)..... | 354               | 3454  |

10" casing, 261'; 8¼" casing, 1265'; 6½" casing, 2074'.

## J. H. Six No. 1 Well Record (41).

Battelle district, 1.1 miles southeast of St. Cloud. Authority, Carnegie Natural Gas Company. Completed to 2955', Sept. 21, 1906, and drilled to 3160' Aug. 14, 1907.

| (Elevation, 1110' L-A. T.)            | Thickness. Total. |       |
|---------------------------------------|-------------------|-------|
|                                       | Feet.             | Feet. |
| Unrecorded .....                      | 885               | 885   |
| Pittsburgh coal.....                  | 8                 | 893   |
| Unrecorded .....                      | 1242              | 2135  |
| Big Injun sand.....                   | 230               | 2365  |
| Unrecorded .....                      | 475               | 2840  |
| Fifty-foot sand.....                  | 54                | 2894  |
| Unrecorded .....                      | 18                | 2912  |
| Gordon Stray sand.....                | 24                | 2936  |
| Unrecorded .....                      | 9                 | 2945  |
| Sand, Gordon, (gas, 2955'-2965')..... | 10                | 2955  |
| Unrecorded .....                      | 130               | 3085  |

|   | Thickness.           | Total. |
|---|----------------------|--------|
|   | Feet.                | Feet.  |
| Fourth sand.....  | 12                   | 3097   |
| Unrecorded .....  | 48                   | 3145   |
| Fifth sand .....  | 10                   | 3155   |
| Unrecorded to bottom.....   | 5                    | 3160   |
| 10" casing, 130'; 8¼" casing, 1330'; 6¾" casing, 2125'; 3" tubing, 2965'. |                      |        |
| Pressure test in 3" tubing:   |                      |        |
| ½ minute, 300 lbs.  | 4th minute, 400 lbs. |        |
| 1st minute, 380 lbs.  | 5th minute, 410 lbs. |        |
| 2nd minute, 390 lbs.  | 6th minute, 500 lbs. |        |

**Lewis Lemley No. 1 Well Record (43).**

Battelle district, 1.5 miles S 10° E of St. Cloud. Authority Fisher Oil Company. Completed July 19, 1904.

|  | Thickness.              | Total. |
|--|-------------------------|--------|
|  | Feet.                   | Feet.  |
| Unrecorded .....   | 1157                    | 1157   |
| Pittsburgh coal and unrecorded.....                      | 963                     | 2120   |
| Salt sand .....  | 60                      | 2180   |
| Unrecorded .....   | 45                      | 2225   |
| Red rock .....   | 95                      | 2320   |
| Slate and lime.....                                      | 50                      | 2370   |
| Big Lime.....  | 66                      | 2436   |
| Big Injun sand (gas, 2501') and unrecorded to bottom.... | 70                      | 2506   |
| Conductor, 14'; 8¼" casing, 1550'; 6¾" casing, 2384'.    |                         |        |
| Pressure test in 4" tubing:                              |                         |        |
| 1st ½ minute, 260 lbs.                                   | 4th minute, 680 lbs.    |        |
| 1st minute, 380 lbs.                                     | 5th minute, 685 lbs.    |        |
| 1½ minute, 500 lbs.                                      | 10th minute, 695 lbs.   |        |
| 3rd minute, 635 lbs.                                     | Rock pressure, 700 lbs. |        |

An open flow test from 4" vent with a diaphragm gage registered 12½ pounds, equivalent to 10,400,000 cubic feet of gas in 24 hours. The foregoing tests were made in the presence of the writer on Aug. 2, 1904. Although 8½ years old the above well is still producing gas in paying quantity.

**Marion Henderson No. 2411 Well Record (44A).**

Battelle district, 2.2 miles northwest of St. Leo. Authority, Philadelphia Company. Completed Nov. 22, 1911.

|  | Thickness. | Total. |
|--|------------|--------|
|  | Feet.      | Feet.  |
| Unrecorded .....                               | 830        | 830    |
| Mapletown (Sewickley) coal and unrecorded..... | 90         | 920    |
| Pittsburgh coal and unrecorded.....            | 1230       | 2150   |
| Big Lime .....                                 | 70         | 2220   |
| Big Injun sand.....                            | 220        | 2440   |
| Unrecorded .....                               | 505        | 2945   |

|                                      | Thickness. Total |       |
|--------------------------------------|------------------|-------|
|                                      | Feet.            | Feet. |
| Sand (Thirty-foot) (gas, 2980')..... | 52               | 2997  |
| Unrecorded .....                     | 88               | 3085  |
| Gordon sand.....                     | 17               | 3102  |
| Unrecorded .....                     | 100              | 3202  |
| Fifth sand .....                     | 18               | 3220  |

First pressure test in 6½" casing:

|                      |                                    |
|----------------------|------------------------------------|
| 5th minute, 8 lbs.   | 13th minute, 65 lbs.               |
| 10th minute, 15 lbs. | Rock pressure in 2 hours, 235 lbs. |
| 15th minute, 30 lbs. |                                    |

"Shot Nov. 28, 1911, and increased about one-half."

### Abe W. Whisler No. 2407 Well Record (45).

Battelle district, 1.4 miles northeast of Cottontown. Authority, Philadelphia Company. Completed July 29, 1911.

|                                     | Thickness. Total |       |
|-------------------------------------|------------------|-------|
|                                     | Feet.            | Feet. |
| (Elevation, 1170' B-A. T.)          |                  |       |
| Unrecorded .....                    | 1015             | 1015  |
| Pittsburgh coal and unrecorded..... | 1190             | 2205  |
| Big Lime .....                      | 80               | 2285  |
| Big Injun sand.....                 | 215              | 2505  |
| Unrecorded .....                    | 650              | 3155  |
| Gordon Stray sand.....              | 15               | 3170  |
| Unrecorded .....                    | 3                | 3173  |
| Gordon sand .....                   | 22               | 3195  |
| Unrecorded .....                    | 13               | 3208  |
| Fourth sand (gas, 3210'-3217')..... | 19               | 3227  |
| Unrecorded to bottom.....           | 55               | 3282  |

First pressure test in 6½" casing:

|                       |                       |
|-----------------------|-----------------------|
| 1st ½ minute, 10 lbs. | 10th minute, 115 lbs. |
| 1st minute, 15 lbs.   | 15th minute, 155 lbs. |
| 2nd minute, 25 lbs.   | 30th minute, 290 lbs. |
| 5th minute, 60 lbs.   |                       |

"Shot Aug. 1, 1911, and increased one-half."

### John M. Liming No. 2303 Well Record (48).

Battelle district, 1.9 miles east of Cottontown. Authority, Philadelphia Company. Completed Oct. 30, 1909.

|  | Thickness. Total |       |
|--|------------------|-------|
|  | Feet.            | Feet. |
| (Elevation, 1130' B-A. T.)                                 |                  |       |
| Unrecorded .....   | 946              | 946   |
| Pittsburgh coal and unrecorded.....                        | 1276             | 2222  |
| Big Injun sand (gas, 2287'-2302') and unrecorded to bottom | 97               | 2319  |

First pressure test in 4" tubing:

|                        |                         |
|------------------------|-------------------------|
| 1st ½ minute, 110 lbs. | 5th minute, 440 lbs.    |
| 1st minute, 175 lbs.   | 10th minute, 550 lbs.   |
| 2nd minute, 275 lbs.   | Rock pressure, 625 lbs. |

**Sol. S. Lemley No. 1 Well Record (49).**

Battelle district, 1.8 miles northwest of St. Leo. Authority, Philadelphia Company.

| (Elevation, 1170' B-A. T.)                                   | Thickness. Total. |       |
|--|-------------------|-------|
|  | Feet.             | Feet. |
| Unrecorded .....   | 995               | 995   |
| <b>Pittsburgh coal and unrecorded</b> .....                  | 480               | 1475  |
| <b>Sand, Dunkard</b> .....                                   | 125               | 1600  |
| Unrecorded .....   | 75                | 1675  |
| <b>Gas sand</b> .....  | 70                | 1745  |
| Unrecorded .....   | 180               | 1925  |
| <b>Salt sand</b> .....                                       | 65                | 1990  |
| Unrecorded .....   | 174               | 2164  |
| <b>Little lime</b> .....                                     | 10                | 2174  |
| Unrecorded .....   | 27                | 2203  |
| <b>Big Lime</b> .....  | 64                | 2267  |
| <b>Big Injun sand</b> .....                                  | 193               | 2460  |
| Unrecorded .....   | 455               | 2915  |
| <b>Fifty-foot sand</b> .....                                 | 15                | 2930  |
| Unrecorded .....   | 81                | 3011  |
| <b>Thirty-foot sand (gas, 3036'; oil show)</b> .....         | 35                | 3046  |
| Unrecorded .....   | 109               | 3155  |
| <b>Sand, (Gordon)</b> .....                                  | 10                | 3165  |
| Unrecorded .....   | 27                | 3192  |
| <b>Sand, (Fourth)</b> .....                                  | 23                | 3215  |
| Unrecorded .....   | 25                | 3240  |
| <b>Sand, (Fifth)</b> .....                                   | 17                | 3257  |
| Unrecorded .....   | 129               | 3386  |
| <b>Sand, (Bayard) (shell) and unrecorded to bottom</b> ..... | 62                | 3458  |

The above well was abandoned on completion as a 'dry hole.

**Amy Maple No. 1 Well Record (50).**

Battelle district, 1.7 miles northwest of St. Leo. Authority, Manufacturers Light & Heat Company.

|   | Thickness. Total. |       |
|---|-------------------|-------|
|   | Feet.             | Feet. |
| <b>Conductor</b> .....                  | 12                | 12    |
| Unrecorded .....                        | 898               | 910   |
| <b>Mapletown (Sewickley) coal</b> ..... | 95                | 910   |
| Unrecorded .....                        | 95                | 1005  |
| <b>Pittsburgh coal</b> .....            | 95                | 1005  |
| Unrecorded .....                        | 510               | 1515  |
| <b>Big Dunkard sand</b> .....           | 75                | 1590  |
| Unrecorded .....                        | 44                | 1634  |
| <b>Gas sand</b> .....                   | 123               | 1757  |
| Unrecorded .....                        | 65                | 1822  |
| <b>First Salt sand</b> .....            | 40                | 1862  |
| Unrecorded .....                        | 8                 | 1950  |
| <b>Second Salt sand</b> .....           | 70                | 2020  |

|   | Thickness. | Total. |
|---|------------|--------|
|   | Feet.      | Feet.  |
| Unrecorded (red rock at 2195') .....                                      | 200        | 2220   |
| Big Lime .....  | 83         | 2303   |
| Big Injun sand .....  | 195        | 2498   |
| Unrecorded .....  | 452        | 2950   |
| Fifty-foot sand .....   | 40         | 2990   |
| Unrecorded .....  | 10         | 3000   |
| Thirty-foot sand .....  | 34         | 3034   |
| Unrecorded .....  | 4          | 3038   |
| Sand, (Thirty-foot) (gas, 3049') .....                                    | 20         | 3058   |
| Unrecorded .....  | 13         | 3071   |
| Sand, (Stray) .....   | 26         | 3097   |
| Unrecorded .....  | 33         | 3130   |
| Sand, (Gordon) .....  | 55         | 3185   |
| Unrecorded .....  | 40         | 3225   |
| Sand, (Fourth) .....  | 5          | 3230   |
| Unrecorded to bottom .....  | 78         | 3308   |
| 10" casing, 270'; 8¼" casing, 1515'; 6¾" casing, 2274'; 4" tubing, 3049'. |            |        |

Pressure test in 4" tubing:

1st minute, 35 lbs.; rock pressure, 950 lbs.

The Fred O. Liming Well (51), located on Middle fork. 2 miles southwest of Wadestown, and completed Oct. 30, 1909, had a small gas show at a depth of 3470 feet, 2400 feet below the Pittsburgh coal, in "shells" that appear to represent the Bayard sand. The well was abandoned as non-productive.

The following is the record of a well located only 0.3 mile northeastward, in which gas pays were encountered in three different sands; viz., Big Injun, Thirty-foot and Gordon:

### Sol M. Shriver No. 2306 Well Record (52).

Battelle district, 1.7 miles southwest of Wadestown. Authority, Philadelphia Company. Completed Oct. 30, 1909.

|  | Thickness. | Total. |
|--|------------|--------|
| (Elevation, 1130' B-A. T.)             | Feet.      | Feet.  |
| Unrecorded .....                       | 935        | 935    |
| Pittsburgh coal .....                  | ...        | 935    |
| Unrecorded .....                       | 1290       | 2225   |
| Big Injun sand (gas, 2239') .....      | 187        | 2412   |
| Unrecorded .....                       | 363        | 2775   |
| Sand, (Berea) .....                    | 10         | 2785   |
| Unrecorded (30-ft. gas at 2937') ..... | 210        | 2995   |
| Gordon Stray sand (gas, 3005') .....   | 39         | 3034   |
| Unrecorded .....                       | 41         | 3075   |
| Sand (Gordon) .....                    | 15         | 3090   |
| Unrecorded to bottom .....             | 5          | 3095   |

Pressure test in 3" tubing:

1st ½ minute, 50 lbs.

1st minute, 90 lbs.

2nd minute, 125 lbs.

5th minute, 220 lbs.

10th minute, 350 lbs.

Rock pressure, 805 lbs.

The following is the record of a deep well more than two-thirds down the eastern slope of the Amity anticline, near the axis of the Waynesburg Basin. As should be expected in this trough, the Big Injun is water bearing. Light gas shows were encountered in the Fifth and Bayard sands, but the well was abandoned as non-productive. Four coals are recorded above the top of the Conemaugh series, all apparently of minable thickness:

### John Estel Heirs No. 1 Well Record (53).

Battelle district, 1 mile N 15° E of St. Leo. Authority, Manufacturers Light & Heat Company. Completed Aug. 17, 1910.

|                                   | Thickness. Total. |       |
|-----------------------------------|-------------------|-------|
|                                   | Feet.             | Feet. |
| Conductor .....                   | 14                | 14    |
| Unrecorded .....                  | 796               | 810   |
| Native (Washington) coal.....     | 3                 | 813   |
| Unrecorded .....                  | 132               | 945   |
| Fairview (Waynesburg) coal.....   | 4                 | 949   |
| Unrecorded .....                  | 293               | 1242  |
| Mapletown (Sewickley) coal.....   | 6                 | 1248  |
| Unrecorded .....                  | 94                | 1342  |
| Pittsburgh coal .....             | 8                 | 1350  |
| Unrecorded .....                  | 390               | 1740  |
| Little Dunkard sand.....          | 25                | 1765  |
| Unrecorded .....                  | 81                | 1846  |
| Big Dunkard sand.....             | 44                | 1890  |
| Unrecorded .....                  | 90                | 1980  |
| Gas sand .....                    | 85                | 2065  |
| Unrecorded .....                  | 200               | 2265  |
| Salt sand .....                   | 65                | 2330  |
| Unrecorded .....                  | 207               | 2537  |
| Little Lime .....                 | 17                | 2554  |
| Pencil cave .....                 | 5                 | 2559  |
| Big Lime .....                    | 72                | 2631  |
| Big Injun sand (water 2711')..... | 165               | 2796  |
| Unrecorded .....                  | 473               | 3269  |
| Sand, (Gantz and Fifty-foot)..... | 78                | 3347  |
| Unrecorded .....                  | 11                | 3358  |
| Thirty-foot sand.....             | 22                | 3380  |
| Unrecorded .....                  | 10                | 3390  |
| Shell .....                       | 10                | 3400  |
| Red rock .....                    | 10                | 3410  |
| Sand, (Stray) .....               | 22                | 3432  |
| Unrecorded .....                  | 4                 | 3436  |
| Gordon sand .....                 | 6                 | 3442  |
| Unrecorded .....                  | 18                | 3460  |
| Sand, (Gordon) .....              | 55                | 3515  |
| Unrecorded .....                  | 11                | 3526  |
| Sand, (Fourth) .....              | 29                | 3555  |
| Unrecorded .....                  | 35                | 3590  |
| Fifth sand (gas, 3597').....      | 30                | 3620  |



|  | Thickness. Total. |       |
|--|-------------------|-------|
|  | Feet.             | Feet. |
| Unrecorded .....   | 2                 | 3622  |
| Sand .....   | 4                 | 3626  |
| Unrecorded .....   | 34                | 3660  |
| Sand .....   | 9                 | 3669  |
| Unrecorded .....   | 64                | 3733  |
| Bayard sand (little gas).....  | 3                 | 3736  |
| Unrecorded to bottom.....  | 9                 | 3745  |
| 10" casing, 269'; 8¼" casing, 1856'; 6½" casing, 2579'; 5⅜" casing, 2754'. |                   |       |

On the waters of Pumpkin run in the northern edge of Battelle district some heavy gas wells occur in the Big Injun sand along the eastern slope of the Waynesburg syncline. The presence of good gas wells in a synclinal basin is not unusual in a rising syncline, and an examination of Map II will show that this region occupies a relatively high structure level, since the Pittsburgh coal rises rapidly northeastward to the State line along the axis of the latter trough from the vicinity of St. Leo. The four following records from this field give valuable pressure tests and other data of interest:

#### John Lantz No. 2562 Well Record (19).

Gilmore township, Greene county, Pa., 1.2 miles southeast of Jollytown. Authority, Philadelphia Company. Completed Nov. 26, 1910.

| (Elevation, 990' B-A. T.)                                | Thickness. Total. |       |
|--|-------------------|-------|
|  | Feet.             | Feet. |
| Unrecorded .....   | 710               | 710   |
| Pittsburgh coal.....                                     | ...               | 710   |
| Unrecorded .....   | 1265              | 1975  |
| Big Injun sand (gas, 1981') and unrecorded to bottom.... | 28                | 2003  |
| First pressure test in 6½" casing:                       |                   |       |

|                       |                                     |
|-----------------------|-------------------------------------|
| 1st ½ minute, 50 lbs. | 10th minute, 370 lbs.               |
| 1st minute, 80 lbs.   | 15th minute, 430 lbs.               |
| 2nd minute, 135 lbs.  | 30th minute, 505 lbs.               |
| 5th minute, 280 lbs.  | Rock pressure in 2½ hours, 595 lbs. |

#### T. W. Kinnan No. 1 Well Record (20).

Battelle district, 1 mile southeast of Jollytown. Authority, Charles Shough. Completed Sept. 9, 1911.

| (Elevation, 1060 B-A. T.)                               | Thickness. Total. |       |
|---|-------------------|-------|
|   | Feet.             | Feet. |
| Conductor .....   | 18                | 18    |
| Unrecorded (water, 138 feet, 5 bailers).....            | 262               | 280   |
| Coal, Crabapple? (Washington "A") and unrecorded.....   | 140               | 420   |
| Bluff sand (water, 430', 4 bailers) and unrecorded..... | 20                | 440   |
| Waynesburg coal and unrecorded.....                     | 255               | 695   |

|   | Thickness. | Total. |
|---|------------|--------|
|   | Feet.      | Feet.  |
| Mapletown (Sewickley) coal.....                                     | 6          | 701    |
| Unrecorded .....  | 79         | 780    |
| Pittsburgh coal (4 ballers water).....                              | 8          | 788    |
| Unrecorded .....  | 157        | 945    |
| Murphy sand .....   | 70         | 1015   |
| Black slate .....   | 15         | 1030   |
| Red rock .....  | 55         | 1085   |
| Sand, (Saltsburg).....  | 55         | 1140   |
| Unrecorded .....  | 40         | 1180   |
| Red rock .....  | 5          | 1185   |
| Little Dunkard sand.....  | 53         | 1238   |
| Black streak .....  | 2          | 1240   |
| Big Dunkard sand.....   | 85         | 1325   |
| Black streak (Upper Freeport coal horizon).....                     | 2          | 1327   |
| Lime .....  | 105        | 1432   |
| Coal streak (Upper Kittanning).....                                 | 2          | 1434   |
| Black slate.....  | 21         | 1455   |
| Gas sand .....  | 95         | 1550   |
| Slate .....   | 15         | 1565   |
| Lime .....  | 7          | 1572   |
| Slate .....   | 4          | 1576   |
| Sand (II Cow Run).....  | 44         | 1620   |
| Lime .....  | 20         | 1640   |
| Slate .....   | 15         | 1655   |
| Salt sand (water 1730'. 2 ballers).....                             | 160        | 1815   |
| Black slate .....   | 15         | 1830   |
| Red rock.....   | 95         | 1925   |
| Limé .....  | 30         | 1955   |
| Red rock .....  | 5          | 1960   |
| Black slate.....  | 2          | 1962   |
| Little Lime .....   | 10         | 1972   |
| Pencil cave.....  | 8          | 1980   |
| Big Lime .....  | 79         | 2059   |
| Big Injun sand (steel line measurement) (gas, 2067'-2078')          |            |        |
| to bottom .....   | 40½        | 2099½  |
| 13" casing, 155'; 10" casing, 1080' (settled 8'); 8" casing, 1680'; |            |        |
| 6½" casing, 2014½'.   |            |        |
| "Gas shut in on 6½" casing."  |            |        |

Through J. P. Hagan of Hero, Pa., and Kelley Bros., the contractors, samples of both the Sewickley and Pittsburgh coal beds were obtained from this well for analysis, the composition, calorific value and fuel ratio of which are given in the table of coal analyses.

### Elza Wade No. 2348 Well Record (21).

Battelle district, 1.3 miles northwest of Wise. Authority, Philadelphia Company. Completed Aug. 20, 1910.

|                            | Thickness. | Total. |
|----------------------------|------------|--------|
|                            | Feet.      | Feet.  |
| (Elevation, 1020' B-A. T.) |            |        |
| Unrecorded .....           | 750        | 750    |
| Pittsburgh coal.....       |            | 750    |

|   | Thickness.            | Total. |
|---|-----------------------|--------|
|   | Feet.                 | Feet.  |
| Unrecorded .....  | 1225                  | 1975   |
| Big Lime .....  | 58                    | 2033   |
| Big Injun sand (gas, 2058') and unrecorded to bottom..... | 162                   | 2195   |
| First pressure test in 6 $\frac{1}{8}$ " casing:          |                       |        |
| 1st $\frac{1}{2}$ minute, 19 lbs.                         | 5th minute, 144 lbs.  |        |
| 1st minute, 36 lbs.                                       | 10th minute, 232 lbs. |        |
| 2nd minute, 68 lbs.                                       |                       |        |

This well was drilled on down through the Fifth sand during 1912 without getting any additional gas or any oil.

### Minerva Hennen No. 1 Well Record (23).

Battelle district, 0.4 mile N 20° E of Wise. Authority, Hope Natural Gas Company. Completed June 12, 1907.

|   | Thickness.            | Total. |
|---|-----------------------|--------|
|   | Feet.                 | Feet.  |
| (Elevation, 1050' B-A. T.)                              |                       |        |
| Unrecorded .....  | 667                   | 667    |
| Coal, Mapletown (Sewickley).....                        | 3                     | 670    |
| Unrecorded .....  | 78                    | 748    |
| Coal, Pittsburgh.....                                   | 5                     | 753    |
| Unrecorded .....  | 392                   | 1145   |
| Little Dunkard sand .....                               | 30                    | 1175   |
| Unrecorded .....  | 79                    | 1254   |
| Big Dunkard sand.....                                   | 68                    | 1322   |
| Unrecorded .....  | 128                   | 1450   |
| Gas sand .....  | 45                    | 1495   |
| Unrecorded .....  | 120                   | 1615   |
| Salt sand (water, 1625', 1660', 1705', 1725').....      | 97                    | 1812   |
| Unrecorded .....  | 123                   | 1935   |
| Big Lime .....  | 89                    | 2024   |
| Big Injun sand (gas, 2032' and 2073').....              | 236                   | 2260   |
| Unrecorded .....  | 425                   | 2685   |
| Fifty-foot sand .....                                   | 95                    | 2770   |
| Unrecorded .....  | 169                   | 2939   |
| Sand, (Gordon) .....                                    | 34                    | 2973   |
| Unrecorded .....  | 22                    | 2995   |
| Sand, (Fourth) (gas, 2951').....                        | 8                     | 3003   |
| Unrecorded .....  | 39                    | 3042   |
| Sand (Fifth) (gas, 3067') and unrecorded to bottom..... | 33                    | 3075   |
| Pressure test in 5 $\frac{1}{8}$ " casing at end of     |                       |        |
| 1st minute, 80 lbs.                                     | 10th minute, 205 lbs. |        |
| 2nd minute, 130 lbs.                                    | 11th minute, 205 lbs. |        |
| 3rd minute, 160 lbs.                                    | 12th minute, 205 lbs. |        |
| 4th minute, 180 lbs.                                    | 13th minute, 205 lbs. |        |
| 5th minute, 190 lbs.                                    | 14th minute, 210 lbs. |        |
| 6th minute, 195 lbs.                                    | 15th minute, 210 lbs. |        |
| 7th minute, 200 lbs.                                    | 30th minute, 220 lbs. |        |
| 8th minute, 200 lbs.                                    | 60th minute, 235 lbs. |        |
| 9th minute, 200 lbs.                                    |                       |        |

"Volume,  $\frac{1}{16}$ " mercury in 5 $\frac{1}{8}$ " opening."

The volume test is equivalent to 3,222,000 cubic feet of gas daily.

Two miles southward in Battelle from the Pumpkin Run—Big Injun gas field there occur several good gassers in the Gantz. Fifty-foot, Fourth and Fifth sands. The five following records give the gas horizons, pressure tests and coal data:

### Mary A. Eakin No. 1 Well Record (26).

Battelle district, 1.2 miles northeast of Wadestown. Authority Philadelphia Company. Completed March 21, 1911.

| (Elevation, 1005' B-A. T.)                                  | Thickness. Total.       |       |
|---|-------------------------|-------|
|   | Feet.                   | Feet. |
| Unrecorded .....  | 684                     | 684   |
| Mapletown (Sewickley) coal and unrecorded .....             | 96                      | 780   |
| Pittsburgh coal .....                                       | .....                   | 780   |
| Unrecorded .....  | 1225                    | 2005  |
| Big Lime .....  | 57                      | 2062  |
| Big Injun sand .....  | 193                     | 2255  |
| Unrecorded .....  | 449                     | 2704  |
| Sand, (Gantz and Fifty-foot) (oil, 2717'; gas, 2730') ..... | 91                      | 2795  |
| Unrecorded .....  | 200                     | 2995  |
| Sand, (Fourth) .....  | 15                      | 3010  |
| Unrecorded .....  | 28                      | 3038  |
| Sand, (Fifth) .....   | 35                      | 3073  |
| Unrecorded to bottom .....                                  | 88                      | 3161  |
| Pressure in 6 5/8" casing:                                  |                         |       |
| 1st 1/2 minute, 5 lbs.                                      | 15th minute, 40 lbs.    |       |
| 5th minute, 8 lbs.  | 30th minute, 100 lbs.   |       |
| 10th minute, 20 lbs.  | Rock pressure, 200 lbs. |       |

The drillers in this region have erroneously placed the Gordon at the horizon of the Fourth sand.

### Sol Shriver No. 2 Well Record (27).

Battelle district, 1.4 miles northeast of Wadestown. Authority Hope Natural Gas Co. Completed November 8, 1908.

| (Elevation, 1015' B.A.T.)                                      | Thickness. Total. |       |
|--|-------------------|-------|
|  | Feet.             | Feet. |
| Conductor .....  | 16                | 16    |
| Unrecorded .....   | 259               | 275   |
| Coal, native (Washington) .....                                | 4                 | 279   |
| Unrecorded .....   | 502               | 781   |
| Pittsburgh coal (steel line measurement) .....                 | 8                 | 789   |
| Unrecorded .....   | 506               | 1295  |
| Dunkard sand (steel line measurement) .....                    | 35                | 1330  |
| Unrecorded .....   | 130               | 1460  |
| Gas sand (steel line measurement) .....                        | 130               | 1590  |
| Unrecorded .....   | 10                | 1600  |
| Sand, (II Cow Run) .....                                       | 55                | 1655  |
| Unrecorded .....   | 50                | 1705  |
| Sand, Second salt (water, 1725'; steel line measurement) ..... | 85                | 1790  |
| Unrecorded .....   | 105               | 1895  |
| Maxton sand .....  | 20                | 1915  |

|  | Thickness. Total. |       |
|--|-------------------|-------|
|  | Feet.             | Feet. |
| Unrecorded .....   | 83                | 1998  |
| Pencil cave.....   | 4                 | 2002  |
| Big Lime .....   | 54                | 2056  |
| Unrecorded .....   | 2                 | 2058  |
| Big Injun sand (oil and water, 2151'-2171') (steel line measurement) .....   | 189               | 2247  |
| Unrecorded .....   | 467               | 2714  |
| Sand (Gantz and Fifty-foot) (gas, 2741') (steel line measurement) .....  | 91                | 2805  |
| Unrecorded .....   | 181               | 2986  |
| Gordon Stray sand .....  | 13                | 2997  |
| Unrecorded .....   | 15                | 3012  |
| Sand, (Fourth) (steel line measurement) .....  | 15                | 3027  |
| Unrecorded .....   | 24                | 3051  |
| Sand, (Fifth) (light gas, 3074') and unrecorded to bottom 13" casing, 177'; 10" casing, 1117'; 8½" casing, 1782'; 6¾" casing, 2084'; 5¾" casing, 2197'.<br>Shot November 13, 1908, with 60 quarts; 30' shell; top of first, 2756'; top of second, 2741'. | 24                | 3075  |

### George W. Shriver No. 1 Well Record (29).

Battelle district, 1.3 miles north of Wadestown. Authority, Philadelphia Company.

| (Elevation, 1095' B-A. T.)       | Thickness. Total. |       |
|----------------------------------|-------------------|-------|
|                                  | Feet.             | Feet. |
| Unrecorded .....                 | 866               | 866   |
| Pittsburgh coal.....             | 7                 | 873   |
| Unrecorded .....                 | 1207              | 2080  |
| Big Lime .....                   | 80                | 2160  |
| Big Injun sand.....              | 185               | 2345  |
| Unrecorded .....                 | 715               | 3060  |
| Sand, (Gordon) .....             | 20                | 3080  |
| Unrecorded .....                 | 10                | 3090  |
| Sand, (Fourth) .....             | 10                | 3100  |
| Unrecorded .....                 | 52                | 3152  |
| Sand, (Fifth) (gas, 3155') ..... | 23                | 3175  |
| Unrecorded to bottom .....       | 5                 | 3180  |

First pressure test in 6 5/8" casing:

|                        |                       |
|------------------------|-----------------------|
| 1st. ½ minute, 10 lbs. | 10th minute, 150 lbs. |
| 1st minute, 20 lbs.    | 15th minute, 195 lbs. |
| 2nd minute, 35 lbs.    | 20th minute, 230 lbs. |
| 5th minute, 85 lbs.    |                       |

### L. H. and R. Wilson No. 1 Well Record (32).

Battelle district, 0.4 miles southeast of Wadestown. Authority, South Penn Oil Company.

| (Elevation, 1159' L-A. T.)         | Thickness. Total. |       |
|------------------------------------|-------------------|-------|
|                                    | Feet.             | Feet. |
| Unrecorded .....                   | 365               | 865   |
| Coal, Mapletown, (Sewickley) ..... | 5                 | 870   |
| Unrecorded .....                   | 100               | 970   |
| Pittsburgh coal .....              | 10                | 980   |

|   | Thickness. Total. |       |
|---|-------------------|-------|
|   | Feet.             | Feet. |
| Unrecorded .....  | 1255              | 2235  |
| Big Injun sand (gas, 2293') .....                           | 165               | 2400  |
| Unrecorded .....  | 505               | 2905  |
| Fifty-foot sand (gas, 2910') .....                          | 65                | 2970  |
| Unrecorded .....  | 240               | 3210  |
| Fourth sand (gas, 3212'; oil, 3218'; oil show, 3225') ..... | 35                | 3245  |
| Unrecorded to bottom .....                                  | 220               | 3465  |

This well sprays some oil, probably from the Fourth sand pay at 3218'.

### E. B. Bell No. 2239 Well Record (33).

Battelle district, 0.4 miles northwest of Wadestown. Authority, Philadelphia Company. Completed July 14, 1908.

|   | Thickness. Total. |       |
|---|-------------------|-------|
|   | Feet.             | Feet. |
| Unrecorded .....  | 765               | 765   |
| Mapletown (Sewickley) coal and unrecorded .....         | 92                | 857   |
| Pittsburgh coal .....                                   | ..                | 857   |
| Unrecorded .....  | 1303              | 2160  |
| Big Injun sand .....                                    | 170               | 2330  |
| Unrecorded .....  | 304               | 2634  |
| Thirty-foot sand .....                                  | 50                | 2684  |
| Unrecorded .....  | 91                | 2775  |
| Fifty-foot sand and unrecorded .....                    | 80                | 2855  |
| Unrecorded .....  | 235               | 3090  |
| Fourth sand (gas, 3110') and unrecorded to bottom ..... | 177               | 3267  |

First pressure test in 3" tubing:

1st  $\frac{1}{2}$  minute, 15 lbs.

1st minute, 25 lbs.

2nd minute, 50 lbs.

5th minute, 105 lbs.

10th minute, 185 lbs.

30th minute, 300 lbs.

Rock pressure in 12 hours, 415 lbs.

In the northeastern corner of Battelle district the Waynesburg syncline widens out and the low portion shifts eastward to the waters of Miracle run, rendering conditions ideal for the occurrence of the Fourth sand oil pool north-eastward from Kimberley, since the latter sand is non-water bearing in this portion of the State. The field was developed during 1900 and 1901 and consists of 80 to 90 wells which had an initial production varying from 10 to 1300 barrels daily. The four following records from this region will show that the drillers have erroneously correlated the producing horizon with the Gordon instead of the Fourth sand, as the former should belong about 2150 feet below the Pittsburgh coal:

**A. J. Cumberledge No. 2 Well Record (55).**

Battelle district, 0.2 miles southwest of Brave. Authority, South Penn Oil Company. Completed, December 19, 1901.

| (Elevation, 1015' B-A. T.)  | Thickness. Total. |       |
|---|-------------------|-------|
|   | Feet.             | Feet. |
| Unrecorded .....  | 720               | 720   |
| Coal, Pittsburgh .....  | .....             | 720   |
| Unrecorded .....  | 1290              | 2010  |
| Big Injun sand (gas and oil, 2020') .....   | 200               | 2210  |
| Unrecorded .....  | 443               | 2653  |
| Fifty-foot sand .....   | 57                | 2710  |
| Unrecorded .....  | 190               | 2900  |
| Sand, (Gordon) .....  | 25                | 2925  |
| Unrecorded .....  | 45                | 2970  |
| Sand, (Fourth) (gas, 2973'; oil, 3980') and unrecorded to bottom .....  | 24                | 2994  |
| 13½" casing, 157'; 10" casing, 1183'; 8½" casing, 1623'; 6 5/8" casing, 2048'; 5 3/16" casing, 2232'; 4½x4" casing, 320'. |                   |       |

**Juretta Eddy No. 2 Well Record (56).**

Battelle district, 0.5 mile southeast of Shamrock. Authority, South Penn Oil Company. Completed July 1, 1900.

| (Elevation, 1275' B-A. T.)   | Thickness. Total. |       |
|--|-------------------|-------|
|  | Feet.             | Feet. |
| Unrecorded, .....  | 900               | 900   |
| Coal, Pittsburgh .....   | .....             | 900   |
| Unrecorded .....   | 1310              | 2210  |
| Big Injun sand (gas 2230' and 2240') .....   | 150               | 2360  |
| Unrecorded .....   | 520               | 2880  |
| Fifty-foot sand .....  | 55                | 2935  |
| Unrecorded .....   | 215               | 3150  |
| Sand, (Fourth) .....   | 35                | 3185  |
| Unrecorded .....   | 35                | 3220  |
| Sand, (Fifth) (oil, 3222') and unrecorded to bottom .....                          | 17                | 3237  |
| 10" casing, 1270'; 8½" casing, 1794'; 6 5/8" casing, 1944'; 5 3/16" casing, 2240'. |                   |       |

If the above record is correct, the oil pay evidently occurs in the Fifth.

**Accha Eddy No. 9 Well Record (58).**

Battelle district, at Bula. Authority, South Penn Oil Company. Completed Oct. 11, 1901.

| (Elevation, 1010' B-A. T.) | Thickness. Total. |       |
|----------------------------|-------------------|-------|
|                            | Feet.             | Feet. |
| Unrecorded .....           | 730               | 730   |
| Coal Pittsburgh .....      | .....             | 730   |
| Unrecorded .....           | 1277              | 2007  |
| Big Injun sand .....       | 193               | 2200  |
| Unrecorded .....           | 535               | 2735  |
| Sand, (Thirty-foot) .....  | 65                | 2800  |

|  | Thickness. | Total. |
|--|------------|--------|
|  | Feet.      | Feet.  |
| Unrecorded .....   | 95         | 2895   |
| Sand, (Gordon) .....   | 15         | 2910   |
| Unrecorded .....   | 54         | 2964   |
| Sand, (Fourth) oil, 2974') and unrecorded to bottom ...                        | 24         | 2988   |
| 13¼" casing, 130'; 10" casing, 1206'; 8¼" casing, 1999'; 6½"                   |            |        |
| casing, 1865'; 5 3/16" casing, 2471'; 4½x4" casing, 207'.                      |            |        |
| "Initial production, 50 bbls. daily and making 5 bbls. daily in August, 1912." |            |        |

The **Accha Eddy No. 4 well (59)**, the largest well in the field, had an initial production of 1300 barrels daily from the Fourth sand.

### Jerry Merriner No. 1 Well Record (61).

Battelle district, 0.8 mile west of Bula. Authority, South Penn Oil Company. Completed August, 14, 1900.

|  | Thickness. | Total. |
|--|------------|--------|
| (Elevation, 1080' B-A. T.)                             | Feet.      | Feet.  |
| Unrecorded .....                                       | 792        | 792    |
| Coal, Pittsburgh .....                                 | ..         | 792    |
| Unrecorded .....                                       | 1283       | 2075   |
| Big Injun sand .....                                   | 50         | 2225   |
| Unrecorded .....                                       | 490        | 2715   |
| Fifty-foot sand (oil and gas, 2715') .....             | 55         | 2770   |
| Unrecorded .....                                       | 200        | 2970   |
| Sand, (Gordon) (heavy gas, 2970') .....                | 18         | 2988   |
| Unrecorded .....                                       | 45         | 3033   |
| Sand, Fourth (oil, 3040') and unrecorded to bottom ... | 17         | 3050   |

This well starts 30 feet above the Jollytown coal and it was evidently a good gasser in the Gordon as well as an oil producer from the Fourth.

Immediately southwest of the Bula oil pool there are about a dozen gas wells. The two following records from wells in this locality show the main gas pay as the Fourth sand.

### Henry Fox Heirs No. 1 Well Record (73).

Battelle district, 0.9 mile N. 75° W. of Miracle Run. Authority, South Penn Oil Company. Completed August 26, 1899.

|   | Thickness. | Total. |
|---|------------|--------|
| (Elevation, 1120' B-A. T.)                  | Feet.      | Feet.  |
| Unrecorded .....                            | 830        | 830    |
| Coal, Pittsburgh .....                      | ..         | 830    |
| Unrecorded .....                            | 1260       | 2090   |
| Big Injun sand (gas, 2170' and 2180') ..... | 216        | 2306   |



|  | Thickness. | Total |
|--|------------|-------|
|  | Feet.      | Feet. |
| Unrecorded .....   | 429        | 2735  |
| Fifty-foot sand .....  | 65         | 2800  |
| Unrecorded .....   | 185        | 2985  |
| Sand, (Gordon) .....   | 30         | 3015  |
| Unrecorded .....   | 40         | 3055  |
| Sand, (Fourth) (gas, heavy, 3066') and unrecorded to<br>bottom .....                                     | 15         | 3070  |
| 10" casing, 146'; 8½" casing, 1340'; 6 5/8" casing, 2054'; 5 3/16"<br>casing, 2219'; 4½x4" casing, 306'. |            |       |

### Zadoc Wise No. 1 Well Record (74).

Battelle district, 1 mile southwest of Kimberley. Authority, Battelle Oil Company. Completed February 23, 1896.

|   | Thickness. | Total |
|---|------------|-------|
| (Elevation, 1010' B.A. T.)                                | Feet.      | Feet. |
| Unrecorded .....  | 744        | 744   |
| Pittsburgh coal .....                                     | 10         | 754   |
| Unrecorded .....  | 1320       | 2074  |
| Big Injun sand (oil show, 2075') and unrecorded .....     | 864        | 2938  |
| Sand, (Fourth) (strong gas).....                          | 3          | 2941  |
| Black slate .....   | 14         | 2955  |
| Sand, (Fourth) (oil, 2963' and 2973') hard and close..... | 29         | 2984  |
| Slate to bottom .....                                     | 2          | 2986  |

Small oil well in Fourth sand.

The above well was one among the first drilled on the waters of Miracle run and led to the opening of the Fourth sand oil pool in the vicinity of Crossroads, Battelle district. In the latter pool, consisting of 30 to 35 wells, the producing horizon belongs 2210 to 2225 feet below the Pittsburgh coal—60 to 75 feet too low in the measures for the Gordon.

The **Sarah E. Eddy No. 1 well (79)**, located 0.5 mile northwest of Crossroads, the log of which is published on pages 142 and 143 of Vol. I(A) of the State Survey reports, had an initial production of 260 barrels for the first 24 hours and 360 barrels for the second 24 hours from the Fourth sand, in addition to gas pays in the Big Injun and Gordon.

The following is the record of probably the largest oil producer in the Crossroads pool:

**Elihu Eddy Heirs No. 6 Well Record (81).**

Battelle district, at Crossroads. Authority, South Penn Oil Company. Completed Aug. 31, 1899.

| (Elevation, 1160' B-A. T.)  |          | Thickness.            | Total.  |
|---|----------|-----------------------|---------|
|   |          | Feet.                 | Feet.   |
| Unrecorded  | .....    | 895                   | 895     |
| Coal, Pittsburgh  | .....    | ..                    | 895     |
| Unrecorded  | .....    | 1268                  | 2163    |
| Big Injun sand  | .....    | 187                   | 2350    |
| Unrecorded  | .....    | 445                   | 2795    |
| Fifty-foot sand   | .....    | 95                    | 2890    |
| Unrecorded  | .....    | 153                   | 3043    |
| Sand, (Gordon)  | .....    | 22                    | 3065    |
| Unrecorded  | .....    | 48                    | 3113    |
| Sand, Gordon? (first oil pay, light, 3131'; second oil pay good, 3140'-3145')                         | .....32' | } (Fourth sand) ..... | 47 3160 |
| Sand, hard  | .....2   |                       |         |
| Sand, soft  | .....10  |                       |         |
| Sand, harder, to bottom   | .....3   |                       |         |
| 10" casing, 350'; 8½" casing, 1405'; 6 5/8" casing, 2080'; 5 3/16" casing, 2295'; 4½x4" casing, 830'. |          |                       |         |

This well had an initial oil production of 2700 barrels daily, but in August, 1912, it had fallen to 3 barrels daily. It starts 110 feet by hand-level above the Jollytown coal.

The following is the detailed log of a light Gordon sand gasser located along the western border of the Crossroads Fourth sand oil pool. The log is interesting in that 4 minable coals are recorded:

**M. J. Garrison No. 1 Well Record (80).**

Battelle district, 1.2 miles southeast of Wadestown. Authority, South Penn Oil Company.

| (Elevation, 1120' B-A. T.) |       | Thickness. | Total. |
|----------------------------|-------|------------|--------|
|                            |       | Feet.      | Feet.  |
| Conductor                  | ..... | 12         | 12     |
| Unrecorded                 | ..... | 363        | 375    |
| Coal, (Washington)         | ..... | 2          | 377    |
| Unrecorded                 | ..... | 103        | 480    |
| Bluff sand                 | ..... | 25         | 505    |
| Unrecorded                 | ..... | 19         | 524    |
| Fairview (Waynesburg) coal | ..... | 5          | 529    |
| Unrecorded                 | ..... | 262        | 791    |
| Mapletown (Sewickley) coal | ..... | 9          | 800    |
| Unrecorded                 | ..... | 90         | 890    |
| Pittsburgh coal            | ..... | 6          | 896    |
| Unrecorded                 | ..... | 511        | 1407   |
| Sand, (I Cow Run)          | ..... | 7          | 1414   |
| Unrecorded                 | ..... | 79         | 1493   |
| Soft sand                  | ..... | 35         | 1528   |

|   | Thickness. | Total. |
|---|------------|--------|
|   | Feet.      | Feet.  |
| Unrecorded .....  | 52         | 1580   |
| Gas sand.....   | 45         | 1625   |
| Unrecorded .....  | 49         | 1674   |
| Sand, (II Cow Run).....   | 42         | 1716   |
| Unrecorded, (water, 1700') .....  | 134        | 1850   |
| Salt sand.....  | 25         | 1875   |
| Unrecorded .....  | 215        | 2090   |
| Pencil cave .....   | 4          | 2094   |
| Big Lime .....  | 82         | 2176   |
| Red rock .....  | 4          | 2180   |
| Big Injun sand, (white sand, 2197'; water, 2257'; break,<br>2289'-2290' ..... | 134        | 3214   |
| Unrecorded .....  | 36         | 2350   |
| Sand, hard .....  | 20         | 2370   |
| Unrecorded .....  | 289        | 2659   |
| Thirty-foot sand .....  | 27         | 2686   |
| Unrecorded .....  | 110        | 2796   |
| Gantz sand .....  | 48         | 2844   |
| Slate .....   | 3          | 2847   |
| Fifty-foot sand (small show of oil and gas, 2801').....                       | 29         | 2876   |
| Unrecorded .....  | 109        | 2985   |
| Sand .....  | 23         | 3008   |
| Unrecorded .....  | 4          | 3012   |
| Gordon Stray sand .....   | 18         | 3030   |
| Unrecorded .....  | 12         | 3042   |
| Gordon sand (oil and gas, 3053') .....  | 33         | 3075   |
| Slate .....   | 4          | 3079   |
| Sand .....  | 13         | 3092   |
| Slate .....   | 5          | 3097   |
| Fourth sand .....   | 14         | 3111   |
| Slate, soft and dark .....  | 2          | 3113   |
| Fifth sand .....  | 9          | 3122   |
| Unrecorded to bottom .....  | 19         | 3141   |
| 10" casing, 256'; 8½" casing, 1429'; 6 5/8" casing, 2287'.                    |            |        |

Southward from Crossroads there are found several scattered oil wells in the Fourth sand on Miracle run as is revealed in the two following records:

#### F. M. Efaw No. 1 Well Record (86).

Battelle district, 1.1 miles S., 5° W. of Crossroads. Authority, Manufacturers' Light and Heat Company. Completed May 2, 1908.

|  | Thickness. | Total. |
|--|------------|--------|
|  | Feet.      | Feet.  |
| Conductor .....                                | 16         | 16     |
| Unrecorded .....                               | 808        | 824    |
| Mapletown (Sewickley) coal and unrecorded..... | 100        | 924    |
| Pittsburgh coal .....                          | ..         | 924    |
| Unrecorded .....                               | 410        | 1334   |
| Little Dunkard sand .....                      | 21         | 1355   |
| Unrecorded .....                               | 95         | 1450   |
| Big Dunkard sand .....                         | 15         | 1465   |

|   | Thickness. Total. |       |
|---|-------------------|-------|
|   | Feet.             | Feet. |
| Unrecorded .....  | 135               | 1600  |
| Gas sand .....  | 50                | 1650  |
| Unrecorded (top of Salt sand broken up) .....                     | 180               | 1830  |
| Second Salt sand .....  | 90                | 1920  |
| Unrecorded .....  | 100               | 2020  |
| Maxton sand .....   | 22                | 2042  |
| Unrecorded .....  | 73                | 2115  |
| Little Lime .....   | 15                | 2130  |
| Pencil cave .....   | 15                | 2145  |
| Big Lime .....  | 80                | 2225  |
| Big Injun sand (water and gas, 2305'; water, 2345') ....          | 180               | 2405  |
| Unrecorded .....  | 415               | 2820  |
| Sand, (Gantz) .....   | 30                | 2850  |
| Unrecorded .....  | 205               | 3055  |
| Sand, (Gordon) white .....  | 30                | 3085  |
| Pencil cave .....   | 4                 | 3089  |
| Sand, Gordon, white .....   | 37                | 3126  |
| Pencil cave .....   | 3                 | 3129  |
| Sand, (Fourth) (1st pay, 3141') and unrecorded to<br>bottom ..... | 18                | 3147  |

All pay, not through sand.

"28. H. P. Warren boiler; 30 H. P. Ajax engine; 84' rig. 10" casing, 210'; 8½" casing, 1436'; 5 3/16" casing, 2351'8". All casing left in well. Cost per foot, \$1.20. Shot May 10, 1909, with 10 quarts glycerine, 3½"x6" shell; top of shot, 3141'; bottom, 3147'.

No increase in production.

Production 1st day, 348 bbls.

Production 3rd day, 630 bbls.

Production 2nd day, 316 bbls.

Production 4th day, 660 bbls.

### Amon Johnson No. 2 Well Record (88).

Located in Battelle district, 1.6 miles north of Galletin. Authority, Manufacturers Light & Heat Company. Completed August 26, 1908.

|  | Thickness. Total. |       |
|--|-------------------|-------|
|  | Feet.             | Feet. |
| (Elevation, 1083' L-A. T.)                   |                   |       |
| Conductor .....                              | 10                | 10    |
| Unrecorded .....                             | 736               | 746   |
| Mapletown (Sewickley) coal .....             | 6                 | 752   |
| Unrecorded .....                             | 106               | 858   |
| Pittsburgh coal.....                         | 9                 | 867   |
| Unrecorded .....                             | 339               | 1206  |
| Little Dunkard sand .....                    | 24                | 1230  |
| Unrecorded .....                             | 320               | 1550  |
| Gas sand .....                               | 62                | 1612  |
| Unrecorded .....                             | 140               | 1752  |
| Salt sand .....                              | 33                | 1785  |
| Unrecorded .....                             | 270               | 2055  |
| Little Lime .....                            | 10                | 2065  |
| Pencil cave.....                             | 10                | 2075  |
| Big Lime .....                               | 75                | 2150  |
| Big Injun sand (water, 2235' and 2245')..... | 155               | 2305  |
| Unrecorded .....                             | 10                | 2315  |
| Squaw sand.....                              | 25                | 2340  |

|   | Thickness.<br>Feet. | Total<br>Feet. |
|---|---------------------|----------------|
| Unrecorded .....  | 306                 | 2646           |
| Berea sand .....  | 15                  | 2661           |
| Unrecorded .....  | 95                  | 2756           |
| Sand, (Gantz) .....   | 50                  | 2806           |
| Unrecorded .....  | 10                  | 2816           |
| Sand, (Fifty-foot) .....  | 36                  | 2852           |
| Unrecorded .....  | 155                 | 3007           |
| Sand, (Gordon) .....  | 20                  | 3027           |
| Unrecorded .....  | 37                  | 3064           |
| Sand, (Fourth) (oil, 3078'-3083') to bottom.....                          | 22                  | 3086           |
| 10" casing, 306'; 8¼" casing, 1397'; 6½" casing, 2150'; 5" casing, 2277'. |                     |                |

Southward from Wadestown on the waters of South fork and Range run there are about 100 producing oil wells in the Gordon and Fourth sands. This field is located along and near the axis of the Waynesburg syncline as should be expected, since both the latter sands are non-water bearing in this portion of the State. Many of the wells in this field were first drilled into the Gordon sand from which they produced oil for sometime. Later they were drilled on down to the Fourth to become good oil producers from that horizon. The eight following records of wells in this field give much data of interest:

### J. M. Hall No. 2 Well Record (99).

Battelle district, 0.2 mile north of St. Leo. Authority, Manufacturers Light & Heat Company. Completed March 31, 1904.

|  | Thickness.<br>Feet. | Total<br>Feet. |
|--|---------------------|----------------|
| Conductor .....  | 12                  | 12             |
| Unrecorded .....   | 1048                | 1060           |
| Mapletown (Sewickley) coal and unrecorded.....   | 100                 | 1160           |
| Pittsburgh coal .....  | ...                 | 1160           |
| Unrecorded .....   | 650                 | 1810           |
| Gas sand .....   | 80                  | 1890           |
| Unrecorded .....   | 210                 | 2100           |
| Salt sand .....  | 80                  | 2180           |
| Unrecorded .....   | 270                 | 2450           |
| Big Injun sand.....  | 200                 | 2650           |
| Unrecorded .....   | 450                 | 3100           |
| Fifty-foot sand (oil show, 3103').....   | 50                  | 3150           |
| Unrecorded .....   | 27                  | 3177           |
| Sand, (Thirty-foot) (oil show, 3177').....   | 23                  | 3200           |
| Unrecorded .....   | 123½                | 3323½          |
| Sand (Gordon) (oil, 3332½) to bottom.....  | 21                  | 3344½          |
| 10" casing, 350'; 8¼" casing, 1565'; 6½" casing, 2610'.<br>"Initial production, 25 bbls. daily." |                     |                |

**E. B. Hall No. 1 Well Record (101).**

Battelle district, 0.3 mile southwest of St. Leo. Authority, Manufacturers Light & Heat Company. Completed Aug. 18, 1902.

| (Elevation, 1080' B.A. T.)   | Thickness. Total. |       |
|--|-------------------|-------|
|  | Feet.             | Feet. |
| Unrecorded .....   | 925               | 925   |
| <b>Pittsburgh coal</b> .....   | ...               | 925   |
| Unrecorded .....   | 85                | 1410  |
| <b>Big Dunkard sand</b> .....  | 20                | 1430  |
| Unrecorded .....   | 160               | 1590  |
| <b>Gas sand</b> .....  | 50                | 1640  |
| Unrecorded .....   | 275               | 1915  |
| <b>Salt sand</b> .....   | 30                | 1945  |
| Unrecorded .....   | 245               | 2160  |
| <b>Big Lime</b> .....  | 75                | 2235  |
| <b>Big Injun sand</b> .....  | 185               | 2420  |
| Unrecorded .....   | 460               | 2880  |
| <b>Fifty-foot sand</b> .....   | 60                | 2940  |
| Unrecorded (little gas, 2980') .....                                       | 141               | 3081  |
| <b>Sand (Gordon) (little gas and oil, 3082')</b> .....                     | 25                | 3106  |
| Unrecorded to bottom .....   | 1                 | 3107  |
| 10" casing, 265'; 8¼" casing, 1410'; 6½" casing, 2170'; 5½" casing, 2366'. |                   |       |

This well had an initial production of 25 bbls. daily and had been making 7 bbls. daily for three years, in August, 1911.

**Wm. Kinney No. 2 Well Record (104).**

Battelle district, 1 mile S 10° E of St. Leo. Authority, Manufacturers Light & Heat Company. Completed Aug. 19, 1907.

|  | Thickness. Total. |       |
|--|-------------------|-------|
|  | Feet.             | Feet. |
| Unrecorded .....   | 1105              | 1105  |
| <b>Pittsburgh coal</b> .....   | ...               | 1105  |
| Unrecorded .....   | 1216              | 2321  |
| <b>Big Injun sand</b> .....  | 201               | 2522  |
| Unrecorded .....   | 716               | 3238  |
| <b>Gordon Stray sand</b> .....   | 15                | 3253  |
| Unrecorded .....   | 8                 | 3261  |
| <b>Gordon sand (oil, 3264'-3266' and 3270')</b> .....  | 34                | 3295  |
| Unrecorded .....   | 37                | 3332  |
| <b>Gordon sand</b> .....   | 12                | 3344  |
| Unrecorded .....   | 14                | 3358  |
| <b>Fourth sand (oil, 3360' and 3372') and unrecorded to bottom</b> .....                       | 25                | 3383  |
| 10" casing, 195'; 8¼" casing, 1513'; 6½" casing, 2362'; 5½" casing, 2547'; 4½x4" casing, 220'. |                   |       |

This well encountered oil in both the Gordon and Fourth sands, and in the latter horizon had an initial production of 1000 bbls. daily.

**W. A. Yost No. 5 Well Record (107).**

Battelle district, 1.4 miles southeast of St. Leo. Authority, South Penn Oil Company. Completed Nov. 23, 1907.

| (Elevation, 1295' B-A. T.)                       | Thickness. Total |       |
|--|------------------|-------|
|  | Feet.            | Feet. |
| Unrecorded .....                                 | 1000             | 1000  |
| Coal, Mapletown, (Sewickley) and unrecorded..... | 105              | 1105  |
| Coal, Pittsburgh.....                            | ...              | 1105  |
| Unrecorded .....                                 | 1293             | 2398  |
| Big Injun sand (water, 2490').....               | 160              | 2558  |
| Unrecorded .....                                 | 706              | 3264  |
| Sand, (Gordon) (oil, 3270').....                 | 46               | 3310  |
| Unrecorded .....                                 | 7                | 3317  |
| Gordon sand .....                                | 31               | 3348  |
| Unrecorded .....                                 | 11               | 3359  |
| Fourth sand (oil, 3366').....                    | 33               | 3392  |
| Unrecorded to bottom.....                        | 3                | 3395  |

**Wilson Haught No. 4 Well Record (96).**

Battelle district, 0.9 mile NE of St. Leo. Authority, South Penn Oil Company.

|   | Thickness. Total |       |
|---|------------------|-------|
|   | Feet.            | Feet. |
| Unrecorded .....  | 887              | 887   |
| Coal, Fairview (Waynesburg) and unrecorded.....   | 261              | 1148  |
| Coal, Mapletown (Sewickley) .....   | 4                | 1152  |
| Unrecorded .....  | 92               | 1244  |
| Coal, Pittsburgh (steel line).....  | 9                | 1253  |
| Unrecorded .....  | 497              | 1750  |
| Sand, Big Dunkard.....  | 50               | 1800  |
| Unrecorded .....  | 135              | 1935  |
| Gas sand.....   | 80               | 2015  |
| Unrecorded .....  | 354              | 2469  |
| Pencil cave .....   | 4                | 2473  |
| Big Lime .....  | 72               | 2545  |
| Big Injun sand (water, 2610').....  | 170              | 2715  |
| Unrecorded .....  | 441              | 3156  |
| Fifty-foot sand .....   | 103              | 3259  |
| Unrecorded .....  | 4                | 3263  |
| Thirty-foot sand .....  | 17               | 3280  |
| Unrecorded .....  | 111              | 3391  |
| Sand, (Gordon) .....  | 55               | 3446  |
| Unrecorded .....  | 49               | 3495  |
| Fourth sand (oil, 3499') and unrecorded to bottom.....                                      | 23               | 3518  |
| 10" casing, 293'; 8¼" casing, 177'; 6½" casing, 2500'; 5½" casing, 2676½'; 4" casing, 180'. |                  |       |

This well had an initial production of 500 bbls. daily.

**M. J. (Crocker) Garrison No. 1 Well Record (93).**

Battelle district, 1.4 miles south of Wadestown. Authority, South Penn Oil Company. Completed March 12, 1909.

| (Elevation, 1075' B-A. T.)                                   | Thickness.<br>Feet. | Total.<br>Feet. |
|--|---------------------|-----------------|
| Unrecorded .....   | 470                 | 470             |
| Bluff sand .....   | 55                  | 525             |
| Coal, Fairview (Waynesburg).....                             | 5                   | 530             |
| Unrecorded .....   | 260                 | 790             |
| Coal, Mapletown (Sewickley).....                             | 9                   | 799             |
| Unrecorded .....   | 86                  | 885             |
| Coal, Pittsburgh.....  | 8                   | 893             |
| Unrecorded .....   | 1287                | 2180            |
| Big Injun sand .....   | 140                 | 2320            |
| Unrecorded .....   | 480                 | 2800            |
| Sand, (Gantz and Fifty-foot) (oil show, 2829'; gas, 2835').. | 100                 | 2900            |
| Unrecorded .....   | 75                  | 2975            |
| Thirty-foot sand .....                                       | 54                  | 3029            |
| Unrecorded .....   | 5                   | 3034            |
| Sand, (Gordon) .....   | 33                  | 3067            |
| Unrecorded .....   | 38                  | 3105            |
| Gordon sand .....  | 15                  | 3120            |
| Unrecorded .....   | 14                  | 3134            |
| Fourth sand (oil, 3144') and unrecorded to bottom.....       | 35                  | 3169            |

"Initial oil production, 10 bbls. daily from Fourth sand."

**M. J. and J. L. Garrison No. 1831 Well Record (82).**

Battelle district, 1.1 miles S 10° E of Wadestown. Authority Hope Natural Gas Company. Completed May 19, 1910.

|   | Thickness.<br>Feet. | Total.<br>Feet. |
|---|---------------------|-----------------|
| Conductor .....   | 16                  | 16              |
| Unrecorded .....  | 664                 | 680             |
| Coal, native (Waynesburg) and unrecorded.....                           | 358                 | 1038            |
| Pittsburgh coal (steel line measurement).....                           | 5                   | 1038            |
| Unrecorded .....  | 397                 | 1435            |
| Little Dunkard sand.....  | 15                  | 1450            |
| Unrecorded .....  | 80                  | 1630            |
| Big Dunkard sand.....   | 20                  | 1650            |
| Unrecorded .....  | 185                 | 1835            |
| Gas sand .....  | 65                  | 1900            |
| Unrecorded .....  | 335                 | 2235            |
| Little Lime .....   | 15                  | 2250            |
| Pencil cave .....   | 5                   | 2255            |
| Big Lime .....  | 65                  | 2320            |
| Big Injun sand (light gas, 2420') (steel line measurement)              | 160                 | 2480            |
| Unrecorded .....  | 470                 | 2950            |
| Sand, (Gantz and Fifty-foot) (light oil and gas, 2968' and 2987') ..... | 130                 | 3080            |
| Unrecorded .....  | 60                  | 3140            |
| Thirty-foot sand .....  | 15                  | 3155            |
| Unrecorded .....  | 49                  | 3204            |
| Gordon Stray sand (steel line measurement).....                         | 16                  | 3220            |



|  | Thickness.<br>Feet. | Total<br>Feet. |
|--|---------------------|----------------|
| Unrecorded .....   | 28                  | 3248           |
| Gordon sand .....  | 7                   | 3255           |
| Unrecorded .....   | 33                  | 3288           |
| Fourth sand (gas, 3290'-3295') and unrecorded to bottom<br>(steel line measurement).....   | 22                  | 3310           |
| 10" casing, 308'; 8¼" casing, 1527'; 6½" casing, 2282'; 5½" cas-<br>ing, 2686'4"; 4¼x4" liner, 191'; 2" tubing, 3311'; lined at 3204'. |                     |                |

### Samuel Eakin No. 4 Well Record (89).

Battelle district, 1.7 miles east of St. Leo. Authority, South Penn Oil Company. Completed Nov. 5, 1898.

| (Elevation, 1155' B-A. T.)                             | Thickness.<br>Feet. | Total<br>Feet. |
|--|---------------------|----------------|
| Unrecorded .....                                       | 865                 | 865            |
| Coal, Mapletown (Sewickley).....                       | 8                   | 873            |
| Unrecorded .....                                       | 89                  | 962            |
| Coal, Pittsburgh.....                                  | 8                   | 970            |
| Unrecorded .....                                       | 1275                | 2245           |
| Big Injun sand (gas show, 2310').....                  | 155                 | 2400           |
| Unrecorded .....                                       | 485                 | 2885           |
| Fifty-foot sand (gas show, 2925').....                 | 80                  | 2965           |
| Unrecorded .....                                       | 90                  | 3075           |
| Stray sand (oil show, 3075') and unrecorded.....       | 45                  | 3120           |
| Gordon sand (oil pay, 3123') and unrecorded.....       | 67                  | 3187           |
| Gordon sand (oil, 3188') and unrecorded to bottom..... | 7                   | 3194           |

Along the eastern edge of Battelle district on the Left branch of Miracle run there are 8 to 10 gas wells near Miracle Run P. O. The two following records are from wells in this pool:

### John & W. L. Parks No. 1 Well Record (127).

Battelle district, 0.8 mile southeast of Miracle Run. Authority, South Penn Oil Company. Completed February 16, 1908.

| (Elevation, 1000' B-A. T.)  | Thickness.<br>Feet. | Total<br>Feet. |
|---|---------------------|----------------|
| Unrecorded .....  | 780                 | 780            |
| Coal, Pittsburgh .....  |                     | 780            |
| Unrecorded .....  | 1270                | 2050           |
| Big Injun sand (gas, good, 2058'; salt water, oil show,<br>2150') .....                             | 150                 | 2200           |
| Unrecorded .....  | 760                 | 2960           |
| Stray sand.....   | 18                  | 2978           |
| Unrecorded .....  | 2                   | 2980           |
| Gordon sand (broken and shelly).....  | 17                  | 2997           |
| Unrecorded .....  | 93                  | 3090           |
| Sand (Fifth) soft and good.....   | 10                  | 3100           |
| Unrecorded .....  | 48                  | 3148           |
| Sand (Bayard) shelly (gas, light, 3148'-3193') to bottom..  | 45                  | 3193           |
| 10" casing, 253'; 8¼" casing, 1271'; 6½" casing, 1786'; 5½" cas-<br>ing, 2188'; 4½x4" casing, 307'. |                     |                |

**Jos. L. Parks No. 1 Well Record (130).**

Battelle district, 0.4 mile north of Miracle Run. Authority, South Penn Oil Company. Completed Aug. 8, 1901.

| (Elevation, 1080' B-A. T.)   | Thickness. | Total.     |
|--|------------|------------|
|  | Feet.      | Feet.      |
| Unrecorded .....   | 683        | 683        |
| <b>Coal, Pittsburgh</b> .....                                      |            | <b>683</b> |
| Unrecorded .....   | 1280       | 1963       |
| Big Injun sand .....   | 151        | 2114       |
| Unrecorded .....   | 499        | 2613       |
| Fifty-foot sand .....  | 45         | 2658       |
| Unrecorded .....   | 184        | 2842       |
| Sand (Gordon) .....  | 35         | 2877       |
| Unrecorded .....   | 40         | 2917       |
| <b>Sand, (Fourth)</b> (gas, 2921' and 2934'; lined at 2921') ..... | 37         | 2954       |
| Slate .....  | 5          | 2959       |
| Fourth sand .....  | 32         | 2991       |
| Unrecorded .....   | 79         | 3070       |
| <b>Fifth sand</b> (gas, 3078') .....                               | 10         | 3080       |
| Slate .....  | 67         | 3147       |
| <b>Bayard sand</b> (gas) .....                                     | 3          | 3150       |
| Slate to bottom .....  | 35         | 3185       |

Gas tested 16/10 water in 5 $\frac{3}{8}$ " casing and 8/10 mercury in 3" opening.

The test shows the well to have had a volume of 1,000,000 cubic feet daily.

In the southeastern corner of Battelle district there are 125 to 130 producing oil wells from the Fourth and Bayard sands along a structural terrace as exhibited on Map II by the wide divergence of the 300 and the 350-foot contours of the Pittsburgh coal. The small group of wells nearly a mile northeast of Ragtown obtained their oil production from the Big Injun and Fourth sands. No logs were obtained from the latter group. The six following records from wells in the first mentioned field exhibit much data of interest and show that the oil horizons are in the Fourth and Bayard sands instead of the Gordon and Fifth as given by the drillers. There the Fourth sand has proved more prolific than the Bayard, some of the wells attaining an initial oil production of over 2000 barrels daily:

**S. T. Fordyce No. 1 Well Record (126).**

Battelle district, 1 mile northwest of Ragtown. Authority, South Penn Oil Company. Completed December 14, 1906.

| (Elevation, 1535' B-A. T.)   | Thickness. Total. |       |
|--|-------------------|-------|
|  | Feet.             | Feet. |
| Unrecorded .....   | 1256              | 1256  |
| Coal, Pittsburgh .....   | 10                | 1266  |
| Unrecorded .....   | 360               | 1626  |
| Sand, Little Dunkard .....   | 40                | 1666  |
| Unrecorded .....   | 71                | 1737  |
| Sand, Big Dunkard .....  | 60                | 1797  |
| Unrecorded .....   | 159               | 1956  |
| Gas sand .....   | 19                | 1975  |
| Unrecorded .....   | 75                | 2150  |
| Salt sand .....  | 102               | 2252  |
| Unrecorded .....   | 108               | 2460  |
| Pencil cave .....  | 8                 | 2468  |
| Big Lime .....   | 77                | 2545  |
| Big Injun sand .....   | 160               | 2705  |
| Unrecorded .....   | 320               | 3025  |
| Sand, (Berea) .....  | 15                | 3040  |
| Unrecorded .....   | 125               | 3165  |
| Fifty-foot sand .....  | 61                | 3226  |
| Unrecorded .....   | 198               | 3424  |
| Gordon Stray sand .....  | 4                 | 3428  |
| Unrecorded .....   | 39                | 3467  |
| Gordon sand .....  | 16                | 3483  |
| Unrecorded .....   | 10                | 3493  |
| Fourth sand (oil pay, 3502' and 3509') and unrecorded to bottom .....  | 22                | 3515  |
| 10" casing, 726'; 8 $\frac{1}{4}$ " casing, 2461'; 6 $\frac{5}{8}$ " casing, 2624'; 5 $\frac{3}{8}$ " casing, 2894'. |                   |       |

The above well made an average of 200 bbls. of oil daily for the first month from the Fourth sand. The first 24 hours after completion it made 427 bbls.

**Haught and Walker No. 24 Well Record (123).**

Battelle district, 0.5 mile S 10° E of Ragtown. Authority South Penn Oil Company. Completed October 16, 1899.

| (Elevation, 1420' B-A. T.) | Thickness. Total. |       |
|----------------------------|-------------------|-------|
|                            | Feet.             | Feet. |
| Unrecorded .....           | 1104              | 1104  |
| Pittsburgh coal .....      |                   | 1104  |
| Unrecorded .....           | 1276              | 2380  |
| Big Injun sand .....       | 130               | 2510  |
| Unrecorded .....           | 500               | 3010  |
| Fifty-foot sand .....      | 50                | 3060  |
| Unrecorded .....           | 210               | 3270  |
| Sand, (Gordon) .....       | 25                | 3295  |
| Unrecorded .....           | 20                | 3315  |

|   | Thickness. | Total. |
|---|------------|--------|
|   | Feet.      | Feet.  |
| sand, (Fourth) (gas pay, light, 3324') and unrecorded.....  | 190        | 3505   |
| Sand, (Bayard) (oil pay, fair, 3505').....  | 9          | 3514   |
| Unrecorded to bottom.....   | 11         | 3525   |
| 10" casing, 255'; 8" casing, 1617'; 6 $\frac{3}{8}$ " casing, 2080'; 5 $\frac{1}{8}$ " casing, 2490'; 4 $\frac{1}{2}$ x4" casing, 322'. |            |        |

The above well had an initial oil production of 200 bbls. daily from the Fourth sand, and 10 bbls. daily from the Bayard.

### Haight and Walker No. 13 Well Record (124).

Battelle district, 0.2 mile south of Ragtown. Authority South Penn Oil Company. Completed April 5, 1899.

| (Elevation, 1220' B-A. T.)   | Thickness. | Total. |
|--|------------|--------|
|  | Feet.      | Feet.  |
| Unrecorded .....   | 909        | 909    |
| Coal, Pittsburgh .....   |            | 909    |
| Unrecorded .....   | 1274       | 2183   |
| Big Injun sand (gas, light, 2275').....  | 140        | 2323   |
| Unrecorded .....   | 487        | 2810   |
| Fifty-foot sand (fair gas).....  | 50         | 2860   |
| Unrecorded .....   | 215        | 3075   |
| Stray sand .....   | 25         | 3100   |
| Unrecorded .....   | 30         | 3130   |
| Sand, (Fourth) (oil pay, 3130' and 3133' and unrecorded to bottom .....  | 16         | 3146   |
| 10" casing, 280'; 8 $\frac{1}{4}$ " casing, 1418'; 6 $\frac{3}{8}$ " casing, 1890'; 5 $\frac{1}{8}$ " casing, 2340'; 4 $\frac{1}{2}$ x4" casing, 323'. |            |        |

The above well had an initial oil production of 500 bbls. daily from the Fourth sand.

### Corbra Anderson No. 2 Well Record (117).

Battelle district, 1.3 miles southwest of Ragtown. Authority, South Penn Oil Company. Completed January 10, 1906.

| (Elevation, 1617' L-A. T.)           | Thickness. | Total. |
|--------------------------------------|------------|--------|
|                                      | Feet.      | Feet.  |
| Conductor .....                      | 12         | 12     |
| Unrecorded .....                     | 873        | 885    |
| Bluff sand .....                     | 70         | 955    |
| Fairview (Waynesburg) coal .....     | 5          | 960    |
| Unrecorded .....                     | 210        | 1170   |
| Mapletown (Sewickley) sandstone..... | 50         | 1220   |
| Mapletown (Sewickley) coal.....      | 7          | 1227   |
| Unrecorded .....                     | 88         | 1315   |
| Pittsburgh coal .....                | 10         | 1325   |

|   | Thickness. Total. |       |
|---|-------------------|-------|
|   | Feet.             | Feet. |
| Unrecorded .....  | 340               | 1665  |
| Little Dunkard sand .....   | 35                | 1700  |
| Unrecorded .....  | 120               | 1820  |
| Big Dunkard sand .....  | 60                | 1880  |
| Unrecorded .....  | 130               | 2010  |
| Gas sand .....  | 80                | 2090  |
| Unrecorded .....  | 125               | 2215  |
| Salt sand .....   | 115               | 2330  |
| Unrecorded .....  | 200               | 2530  |
| Little Lime .....   | 10                | 2540  |
| Pencil cave .....   | 10                | 2550  |
| Big Lime .....  | 64                | 2614  |
| Big Injun sand (gas show, 2690'; oil show, 2695') .....                     | 160               | 2774  |
| Unrecorded .....  | 316               | 3090  |
| Sand, (Berea) .....   | 20                | 3110  |
| Unrecorded .....  | 112               | 3222  |
| Fifty-foot sand .....   | 34                | 3256  |
| Unrecorded .....  | 222               | 3478  |
| Gordon Stray sand .....   | 25                | 3503  |
| Unrecorded .....  | 25                | 3528  |
| Sand (Fourth) (light oil, 3535') .....                                      | 26                | 3554  |
| Unrecorded .....  | 10                | 3564  |
| Fourth sand .....   | 32                | 3596  |
| Black shale to bottom .....   | 173               | 3769  |
| 10" casing, 1335'; 8¼" casing, 1835'; 6½" casing, 2330'; 5½" casing, 2735'. |                   |       |

Initial oil production, 5 bbls. daily, and still making (Aug. 1911) 2 bbls. daily from Fourth sand.

### S. J. Harvey No. 4 Well Record (114).

Battelle district, 1.8 miles northeast of Galletin. Authority South Penn Oil Company.

|  | Thickness. Total. |       |
|--|-------------------|-------|
|  | Feet.             | Feet. |
| Conductor .....  | 14                | 14    |
| Unrecorded .....   | 1131              | 1145  |
| Pittsburgh coal .....  | ...               | 1145  |
| Unrecorded .....   | 1332              | 2477  |
| Big Injun sand .....   | 150               | 2627  |
| Unrecorded .....   | 460               | 3087  |
| Fifty-foot sand .....  | 60                | 3147  |
| Unrecorded .....   | 193               | 3340  |
| Sand, (Gordon) .....   | 20                | 3360  |
| Unrecorded .....   | 1                 | 3361  |
| Sand, (Fourth) (first oil pay, 3362') and unrecorded .....             | 37                | 3398  |
| Fourth sand (first oil pay, 3400') and unrecorded to bottom hole ..... | 10½               | 3408½ |

The Fourth sand appears to be split into two divisions, both of which were productive.

The **Anna Harvey No. 1 well (110)**, located 1.7 miles N 70° E of Galletin, the log of which is published on page 137 of Vol. I(A) of the State Survey reports, had an initial oil production of 2200 bbls. daily from the Fourth sand when completed in 1897, and was still making 8 bbls. daily in Aug., 1911.

Northeastward the Haugit and Walker No. 2, drilled about the same time, had an initial production of 900 bbls. daily from the Fourth sand.

### T. C. Gallagher No. 1 Well Record (108).

Battelle district, 0.3 mile northeast of Galletin. Authority, South Penn Oil Company. Completed in 1896.

| (Elevation, 1630' L-A. T.)   | Thickness.<br>Feet. | Total.<br>Feet. |
|--|---------------------|-----------------|
| Conductor .....  | 16                  | 16              |
| Unrecorded .....   | 1278                | 1294            |
| Pittsburgh coal .....  | 8                   | 1302            |
| Unrecorded .....   | 678                 | 1980            |
| Gas sand .....   | 84                  | 2064            |
| Unrecorded .....   | 136                 | 2200            |
| Salt sand .....  | 43                  | 2243            |
| Unrecorded .....   | 272                 | 2515            |
| Big Lime .....   | 65                  | 2580            |
| Big Injun sand (oil and water, 2704½') .....                               | 138                 | 2718            |
| Break .....  | 2                   | 2720            |
| Squaw sand .....   | 40                  | 2760            |
| Unrecorded .....   | 420                 | 3180            |
| Gantz sand .....   | 15                  | 3195            |
| Break .....  | 5                   | 3200            |
| Fifty-foot sand .....  | 20                  | 3220            |
| Unrecorded .....   | 294½                | 3514½           |
| Sand, (Fourth) (oil, 3523') and unrecorded to bottom .....                 | 26½                 | 3540            |
| 10" casing, 419'; 8¼" casing, 1830'; 6¾" casing, 2570'; 5½" casing, 2770'. |                     |                 |

**Prospective Oil and Gas Areas, Battelle District.**—This district has been quite thoroughly drilled over, yet there remain a few small areas favored both by structure and development that would justify further drilling for oil and gas. (1) That portion in the northwest corner of the district lying immediately north of the straight line joining the S. L. S. Spragg No. 1 well (4) and the Eli White No. 1 (5) appears favorable for gas in the Big Injun, Gantz, Thirty-foot and Fourth sands; (2) that, southwestward along the crest of the Amity anticline from Maple to Pone run, for gas at the

same horizons; (3) that, in the St. Leo region immediately west to the Wetzel county line from the E. B. Hall No. 2 well (100), for oil in the Thirty-foot and Gordon sands; (4) that, on the upper portion of Browns and Joy runs—branches of Camp—for gas in the Big Injun, Fifty-foot, Fourth and Fifth sands; (5) that, southward from the State line to Yeager run immediately along the axis of the Waynesburg syncline, for oil in the Fourth sand, or same horizon as that in which the oil was obtained in the Ed. Clovis No. 1 well (17), located 0.5 mile northeast of Jollytown, with a chance for gas in the Big Injun; (6) that, northeastward from Miracle Run P. O. to the Battelle-Clay district line, for gas, in the Big Injun, Gordon, Fourth and Sixth; and (7), that, along both hill-sides of Miracle run southward from Crossroads to the Efaw (87) and Johnson (88) wells for several new producers in the Fourth sand.

#### Clay District.

Clay district, Monongalia, lies immediately east of Battelle district and adjoins Greene county, Pa., on the north and Marion county, W. Va., on the south. Map II shows its area traversed by four structural folds, viz.; Bellevernon and Mooresville anticlines, and Whiteley and Lambert synclines; hence, its strata are very much warped and tilted as in Battelle, making ideal conditions for the accumulation of the great oil and gas pools therein. The main producing horizons have been the Big Injun, Fourth, Fifth and Bayard sands. The Mt. Morris-Fairview oil field extends in an unbroken belt of wells entirely across the district, following roughly between the 500 and 600-foot contours of the Pittsburgh coal as exhibited on Map II. A small pool of oil in the Bayard sand occurs along Dunkard creek in the northern edge of the district, 0.8 mile northeast of Worley. A narrow belt of Big Injun oil wells extends across the northwest corner of the district from Blacksville southwest to its intersection with the Clay-Battelle line, 2 miles west of Daybrook. A number of gas wells occur along the crest of the Bellevernon anticline in the vicinity of Blacksville; the crest of the Mooresville arch, near Mooresville; and southeast of the

Mt. Morris-Fairview oil belt. The development of the different fields will now be discussed from northwest to southeast across the district.

In the northwestern corner of Clay there are about a dozen gas wells on and near the crest of the Bellevernon anticline, where the principal producing horizon is the Big Injun sand. The four following records exhibit the minute pressure and other data of interest:

### R. S. Thomas No. 1 Well Record (131).

Clay district, 2.3 miles southwest of Blacksville. Authority, Mellon Bros. Completed in 1891.

| (Elevation, 968' L-A. T.)   | Thickness. Total. |       |
|---|-------------------|-------|
|   | Feet.             | Feet. |
| Unrecorded .....  | 1680              | 1680  |
| Lime and unrecorded.....  | 225               | 1915  |
| Big Injun sand (gas, 1930'-1950'; break, 2055').....                      | 181               | 2096  |
| 10" casing, 150'; 7½" casing, 650'; 6¼" casing, 1225'; 4¾" casing, 1730'. |                   |       |

This well blew into the air for several years, according to R. S. Thomas, since it was drilled long before the great gas mains were completed in this region; hence, it was considered the same as a dry hole.

### Estella and R. S. Lantz No. 1589 Well Record (135).

Clay district, 0.5 mile west of Blacksville. Authority, Philadelphia Company. Completed Aug. 21, 1906.

|  | Thickness. Total. |       |
|--|-------------------|-------|
|  | Feet.             | Feet. |
| Unrecorded .....   | 546               | 546   |
| Mapletown (Sewickley) coal and unrecorded.....           | 82                | 628   |
| Pittsburgh coal.....                                     |                   | 628   |
| Unrecorded .....   | 1320              | 1948  |
| Big Injun sand (gas, 2054') and unrecorded to bottom.... | 116               | 2064  |

#### Pressure test:

|                       |                                     |
|-----------------------|-------------------------------------|
| 1st ½ minute, 40 lbs. | 20th minute, 445 lbs.               |
| 1st minute 80 lbs.    | 30th minute, 447 lbs.               |
| 2nd minute 140 lbs.   | 60th minute, 450 lbs.               |
| 5th minute, 320 lbs.  | Rock pressure in 16 hours, 455 lbs. |
| 10th minute, 420 lbs. |                                     |



**Estella and R. S. Lantz No. 1575 Well Record (136).**

Clay district, 0.4 mile southwest of Blacksville. Authority, Philadelphia Company. Completed Oct. 24, 1905.

|  | Thickness. | Total                   |
|--|------------|-------------------------|
| (Elevation, 955' B-A. T.)                                | Feet.      | Feet.                   |
| Unrecorded (gas, 430').....                              | 490        | 490                     |
| Mapletown (Sewickley) coal.....                          |            | 490                     |
| Unrecorded .....   | 80         | 570                     |
| Pittsburgh coal .....                                    |            | 570                     |
| Unrecorded .....   | 1335       | 1905                    |
| Big Injun sand (gas, 1970') and unrecorded to bottom.... | 85         | 1990                    |
| First pressure test in 5 $\frac{3}{8}$ " casing.         |            |                         |
| 1st $\frac{1}{2}$ minute, 135 lbs.                       |            | 5th minute, 635 lbs.    |
| 1st minute, 230 lbs.                                     |            | Rock pressure, 695 lbs. |
| 2nd minute, 385 lbs.                                     |            |                         |

**Estella and R. S. Lantz No. 1576 Well Record (137).**

Clay district, at Blacksville. Authority, Philadelphia Company.

|  | Thickness. | Total |
|--|------------|-------|
| (Elevation, 952' L-A. T.)                                  | Feet.      | Feet. |
| Unrecorded .....   | 476        | 476   |
| Mapletown (Sewickley) coal.....                            | 6          | 482   |
| Unrecorded .....   | 79         | 561   |
| Pittsburgh coal .....                                      | 8          | 569   |
| Unrecorded .....   | 1311       | 1880  |
| Big Injun sand (gas, 1968'-1976') and unrecorded to bottom | 100        | 1980  |
| "Rock pressure, 660 lbs."                                  |            |       |

The above well is reported to have had a showing of oil.

The Strosnider No. 1 well (138), located in the south edge of Blacksville and drilled by the Scott Oil & Gas Company, is reported as having had an initial oil production of 50 barrels daily from the Big Injun and 3 to 4 barrels daily from the Fourth sand. It is quite probable that the deep oil pay in this well was in the Fifth instead of the Fourth sand, since Stone & Clapp<sup>5</sup> report the Wm. Scott (L. L. Thomas) No. 1 well (140), one-eighth mile northeastward as a Fifth sand oil producer. No log was obtained from the Strosnider well.

As mentioned under the description of the Bellevernon anticline, the latter fold dies down within a mile and a half after entering Clay district from Pennsylvania, and forms a terrace-like structure southwestward from Kings run to the Clay-Battelle district line, 2 miles west of Daybrook. Closely

5. Bull. 304, Oil & Gas Fields, Greene Co., Pa., U. S. G. Survey, p. 58; 1907.

following this terrace is a belt of 30 to 40 Big Injun sand oil wells. The following records from wells scattered throughout this field exhibit the oil horizon and the initial production of some of the borings:

### Sol Meyers No. 1 Well Record (148).

Clay district, 1.3 miles S 10° W of Blacksville. Authority J. H. McDermott. Completed Dec. 29, 1904.

| (Elevation, 1110' B-A. T.)   | Thickness.<br>Feet. | Total.<br>Feet. |
|--|---------------------|-----------------|
| Unrecorded .....   | 340                 | 340             |
| Bluff sand and unrecorded.....   | 60                  | 400             |
| Coal, Fairview (Waynesburg) and unrecorded.....  | 248                 | 648             |
| Coal, Mapletown (Sewickley).....   | ...                 | 648             |
| Unrecorded .....   | 108                 | 756             |
| Coal, Pittsburgh .....   | ...                 | 756             |
| Unrecorded .....   | 840                 | 1596            |
| Salt sand and unrecorded.....  | 455                 | 2051            |
| Big Injun sand (first gas, 2068'; second pay of oil and little water, 2176') .....   | 99                  | 2250            |
| Unrecorded to bottom.....  | 6½                  | 2256½           |
| "10" casing, 1120'; 8¼" casing, 1556'; 6¼" casing, 1796' (steel line measurement); 5 ⅜" casing, 2021' (steel line measurement). Lead plug at 2105' to shut off water. Gas enough to run 15 drilling wells. Rock pressure 360 lbs." |                     |                 |

### Sol. Meyers No. 1 Well Record (147).

Clay district, 1.2 miles south of Blacksville. Authority, Carnahan and Debendorfer. Completed Jan. 18, 1905.

| (Elevation, 1104' L-A. T.)   | Thickness.<br>Feet. | Total.<br>Feet. |
|--|---------------------|-----------------|
| Conductor .....  | 12                  | 12              |
| Unrecorded .....   | 316                 | 328             |
| Bluff sand and unrecorded.....   | 72                  | 400             |
| Coal, Fairview (Waynesburg) and unrecorded.....  | 255                 | 655             |
| Coal, Mapletown (Sewickley).....   | ...                 | 655             |
| Unrecorded .....   | 89                  | 744             |
| Coal, Pittsburgh.....  | ...                 | 744             |
| Unrecorded .....   | 571                 | 1315            |
| Dunkard sand .....   | 80                  | 1395            |
| Unrecorded .....   | 165                 | 1560            |
| Sand (II Cow Run and Salt) (water, 1590') .....  | 204                 | 1764            |
| Unrecorded .....   | 234                 | 1994            |
| Big Lime .....   | 40                  | 2034            |
| Big Injun sand (first oil pay, 2140'; second oil pay and water, 2156'-2158') and unrecorded to bottom..... | 128                 | 2162            |
| 13" casing, 120'; 10" casing, 1130'; 8¼" casing, 1569'; 6½" casing, 1764'; 5 ⅜" casing, 1994'.             |                     |                 |

The above well had an initial oil production of 30 bbls daily from the Big Injun, and was still making 10 bbls. daily in August, 1911.

### Reason Sine No. 1 Well Record (149).

Clay district, 1.5 miles south of Blacksville. Authority, Carnahan and Debendorfer. Completed in 1905.

| (Elevation, 1239' L-A. T.)  | Thickness. Total |       |
|---|------------------|-------|
|   | Feet.            | Feet. |
| Conductor .....   | 16               | 16    |
| Unrecorded .....  | 524              | 540   |
| Coal, Fairview (Waynesburg) and unrecorded.....   | 252              | 592   |
| Coal, Mapletown (Sewickley).....  | ...              | 792   |
| Unrecorded .....  | 98               | 890   |
| Coal, Pittsburgh .....  | ...              | 890   |
| Unrecorded (water, 1805').....  | 1279             | 2169  |
| Big Lime .....  | 14               | 2185  |
| Big Injun sand (gas, 2205-2215'; oil, 2173').....   | ...              | ...   |
| 13" casing, 258'; 10" casing, 1271'; 8¼" casing, 1742'; 6½" casing, 1934'; 5¾" casing, 2169'. | ...              | ...   |

Initial oil production, 5 bbls. daily from Big Injun.

### Alpheus Sine No. 1 Well Record (150).

Clay district, 1.5 miles S 5° W of Blacksville. Authority, Carnahan and Debendorfer. Completed in 1904.

| (Elevation, 1152' L-A. T.)  | Thickness. Total |       |
|---|------------------|-------|
|   | Feet.            | Feet. |
| Unrecorded .....  | 700              | 700   |
| Coal, Mapletown (Sewickley).....  | ...              | 700   |
| Unrecorded .....  | 100              | 800   |
| Coal, Pittsburgh .....  | ...              | 800   |
| Unrecorded .....  | 385              | 1185  |
| Little Dunkard sand and unrecorded.....   | 175              | 1360  |
| Big Dunkard sand and unrecorded.....  | 220              | 1580  |
| Salt sand.....  | 248              | 1828  |
| Unrecorded .....  | 200              | 2025  |
| Big Lime .....  | 55               | 2080  |
| Big Injun sand (gas, 2107'-2115'; oil, 2180'-2214') and unrecorded to bottom..... | 134              | 2214  |
| 13" casing, 40'; 10" casing, 1185'; 8¼" casing, 1593'; 6½" casing, 1828'.         | ...              | ...   |

This well had an initial oil production of 50 bbls. daily from the Big Injun, and was still making 8 bbls. daily in August, 1911.

**Alpheus Sine No. 2 Well Record (151).**

Clay district, 1.6 miles S 10° W of Blacksville. Authority, Carnahan and Debendorfer.

| (Elevation, 1274' L-A. T.)                               | Thickness. Total. |       |
|--|-------------------|-------|
|  | Feet.             | Feet. |
| Conductor .....  | 13                | 13    |
| Unrecorded .....   | 532               | 545   |
| Bluff sand and unrecorded.....                           | 371               | 916   |
| Coal, Pittsburgh.....                                    | ...               | 916   |
| Unrecorded .....   | 564               | 1480  |
| Big Dunkard sand and unrecorded.....                     | 220               | 1700  |
| Sand, (II Cow Run, Salt) (water, 1925') and unrecorded.. | 345               | 2045  |
| Big Lime .....   | 64                | 2109  |
| Big Injun sand (gas, 2236'-2260') and unrecorded.....    | 621               | 2730  |
| Sand, (Berea) .....                                      | 20                | 2750  |
| Unrecorded .....   | 116               | 2866  |
| Fifty-foot sand .....                                    | 60                | 2926  |
| Unrecorded .....   | 259               | 3185  |
| Sand, (Fourth) .....                                     | 40                | 3225  |
| Unrecorded .....   | 21                | 3246  |
| Sand, (Fifth) .....                                      | 2                 | 3248  |
| Unrecorded .....   | 85                | 3333  |
| Sand, (Bayard) (gas, 3333').....                         | 3                 | 3336  |
| Unrecorded .....   | 32                | 3368  |
| Bayard sand to bottom.....                               | 3                 | 3371  |

13" casing, 149'; 10" casing, 1280'; 8" casing, 1700'; 6 1/2" casing, 1925'; 5 1/8" casing, 2145'.

In the above well the driller has erroneously correlated the Bayard sand as the Fifth, and although in the immediate vicinity of the Big Injun oil producers on the Myers farm, it proved a gasser at the latter horizon as well as in the Bayard.

**Asa Lemley No. 2 Well Record (152).**

Clay district, 2.1 miles south 10° west of Blacksville. Authority, South Penn and Carter Oil Companies.

| (Elevation, 1195' B- A. T.)       | Thickness. Total. |       |
|-----------------------------------|-------------------|-------|
|                                   | Feet.             | Feet. |
| Loam .....                        | 12                | 12    |
| Slate .....                       | 51                | 63    |
| Unrecorded .....                  | 12                | 75    |
| Sand .....                        | 25                | 100   |
| Slate .....                       | 310               | 410   |
| Sand, Bluff (Waynesburg).....     | 70                | 480   |
| Coal, Waynesburg .....            | 7                 | 487   |
| Slate and lime.....               | 263               | 750   |
| Coal, Mapletown, (Sewickley)..... | 6                 | 756   |
| Lime .....                        | 90                | 846   |
| Coal, Pittsburgh.....             | 9                 | 855   |
| Slate, red rock, etc.....         | 372               | 1227  |

|  | Thickness.<br>Feet. | Total.<br>Feet. |
|--|---------------------|-----------------|
| Little Dunkard sand.....   | 23                  | 1250            |
| Slate .....  | 75                  | 1325            |
| Dunkard sand .....   | 27                  | 1352            |
| Slate .....  | 88                  | 1440            |
| "Gas" (and II Cow Run) sand.....   | 225                 | 1665            |
| Slate and lime.....  | 35                  | 1700            |
| Salt sand .....  | 170                 | 1870            |
| Red rock .....   | 199                 | 2069            |
| Little Lime.....   | 6                   | 2075            |
| Pencil cave .....  | 5                   | 2080            |
| Big Lime .....   | 52                  | 2132            |
| Big Injun sand (gas, 2158'; break, 2227'-2232').....   | 238                 | 2370            |
| Slate and shells.....  | 280                 | 2650            |
| Unrecorded .....   | 100                 | 2750            |
| Gantz sand .....   | 25                  | 2775            |
| Slate and shells.....  | 20                  | 2795            |
| Fifty-foot sand .....  | 105                 | 2900            |
| Slate .....  | 30                  | 2930            |
| Thirty-foot sand.....  | 25                  | 2955            |
| Slate .....  | 20                  | 2975            |
| Gordon Stray sand.....   | 35                  | 3010            |
| Red rock .....   | 106                 | 3116            |
| Sand, (Fourth) .....   | 16                  | 3132            |
| Slate and shells.....  | 124                 | 3256            |
| Sand, (Bayard) .....   | 5                   | 3261            |
| Slate to bottom.....   | 186                 | 3447            |
| 13" casing, 75'; 10" casing, 1200'; 8¼" casing, 1732'; 6%" casing, 1864'; 5½" casing, 2125'. |                     |                 |

### James Lemley Heirs No. 1 Well Record (153).

Clay district, 1.6 miles northwest of Daybrook. Authority, Fisher Oil Company. Completed February 25, 1905.

|  | Thickness.<br>Feet. | Total.<br>Feet. |
|--|---------------------|-----------------|
| (Elevation, 1225' B-A. T.)   |                     |                 |
| Unrecorded .....   | 515                 | 515             |
| Coal, Fairview (Waynesburg) and unrecorded.....  | 265                 | 780             |
| Coal, Mapletown (Sewickley).....   | ...                 | 780             |
| Unrecorded .....   | 95                  | 875             |
| Coal, Pittsburgh .....   | ...                 | 875             |
| Unrecorded .....   | 450                 | 1325            |
| Dunkard sand and unrecorded.....   | 350                 | 1675            |
| Salt sand .....  | 15                  | 1690            |
| Unrecorded .....   | 420                 | 2110            |
| Big Lime .....   | 45                  | 2155            |
| Big Injun sand (gas, 2170' and 2240'; and oil, 2248' and 2281'), and unrecorded to bottom..... | 143                 | 2298            |
| 13" casing, 81'; 10" casing, 1200'; 8¼" casing, 1750'.   |                     |                 |

The above well was a light oil producer from Big Injun, but had been abandoned in August, 1911.

**D. S. Lemley No. 1 Well Record (158).**

Clay district, 1.5 miles northwest of Daybrook. Authority, South Penn Oil Cimpany.

|  | Thickness. | Total. |
|--|------------|--------|
| (Elevation, 1480' B-A. T.)   | Feet.      | Feet.  |
| Unrecorded .....   | 1155       | 1155   |
| <b>Pittsburgh coal</b> .....   |            | 1155   |
| Unrecorded .....   | 281        | 2436   |
| <b>Big Injun sand</b> (first oil pay, 2531'; second oil pay, 2539')<br>and unrecorded to bottom..... | 106        | 2542   |

The above well had an initial oil production of 30 bbls. when drilled about 12 years ago and was still making 3 bbls. daily in August, 1911.

**D. S. Lemley No. 1 Well Record (159).**

Clay district, 1.8 miles N 80° W of Daybrook. Authority, Char tlers Oil Company. Completed March 10, 1906.

|   | Thickness. | Total. |
|---|------------|--------|
| (Elevation, 1165' B- A. T.)   | Feet.      | Feet.  |
| Unrecorded .....  | 856        | 856    |
| <b>Pittsburgh coal</b> .....  | 6          | 862    |
| Unrecorded (salt water, 1736'-1847'; cave, 1100').....  | 1254½      | 2116½  |
| <b>Big Injun sand</b> (gas, 2122½', 2127½', 2159', 2210'; oil, 2223') and unrecorded to bottom.....                                   | 119½       | 2235¾  |
| "Show of oil and gas, 2223'. Ran one bit one hour and filled up and flowed while pulling tools. Made several small flows during day." |            |        |
| "Shot Oct. 1, 1907, with 15 quarts. Top of shot, 2222½'."   |            |        |
| 13" casing, 99'; 10" casing, 1156'; 8¼" casing, 1748'; 6¾" casing, 1872'; 5¾" casing, 2150'. Contract price per foot, \$1.00.         |            |        |

This well had an initial oil production of 25 to 30 bbls daily from the Big Injun, and was still making 4 bbls. daily in August, 1911. It starts 10 to 20 feet above the Jollytown coal.

The **Marion Tennant No. 1 well (162)**, located one mile west of Daybrook, the log of which is published on page 135 of Vol. I(A) of the State Survey reports, had a good oil show in the Big Injun, and a gas pay in the Bayard sand.

The three following records are from wells in the Whiteley Basin, along or near the main valley of Days run:

**John Henderson Heirs No. 1 Well Record (163).**

Clay district, 0.5 mile south of Daybrook. Authority, Chartiers Oil Company. Completed July 1, 1908.

| (Elevation, 1020' B-A. T.)  | Thickness. Total. |       |
|---|-------------------|-------|
|   | Feet.             | Feet. |
| Unrecorded .....  | 635               | 635   |
| Pittsburgh coal .....   |                   | 635   |
| Unrecorded (water, 1620').....  | 1235              | 1870  |
| Big Lime .....  | 62                | 1932  |
| Big Injun sand (oil and water, 2036' and 2062').....  | 193               | 2125  |
| Unrecorded .....  | 450               | 2575  |
| Fifty-foot sand .....   | 80                | 2655  |
| Unrecorded .....  | 405               | 3060  |
| Sand, (Bayard) (small oil show, 3065').....   | 5                 | 3065  |
| Unrecorded (gas, 3090½' and 3094½') to bottom.....  | 173               | 3238  |
| "13" casing, 269' 4"; 10" casing, 963' 4"; 8¼" casing, 1513' 6"; 6½" casing, 1663' 6"; 5½" casing, 2175'. Measurements do not include threads." |                   |       |

**Mary Berry No. 1 Well Record (164).**

Clay district, 0.9 mile northeast of Daybrook. Authority, Chartiers Oil Company. Completed August 26, 1905.

| (Elevation, 990' B-A. T.)  | Thickness. Total. |       |
|--|-------------------|-------|
|  | Feet.             | Feet. |
| Unrecorded .....   | 596               | 596   |
| Pittsburgh coal .....  |                   | 596   |
| Unrecorded (salt water, 1525').....  | 1299              | 1895  |
| Big injun sand (gas) and unrecorded.....   | 131½              | 2026½ |
| "Fifty pound (gas well in top of sand). Small show of oil. Filled up 500' first bit. Salt water at 2003'." |                   |       |
| 10" casing, 625'; 8¼" casing, 830'; 6½" casing, 1615'; 5½" casing, 1900'; 2" tubing, 2026'.                |                   |       |

A farmer living near the well reported it as having a rock pressure of 500 pounds, but the salt water at 2005 feet drowned out the gas. In the writer's judgment it is too low down in the Whiteley Basin to have lasted very long in any event.

**John Moore No. 1 Well Record (165).**

Clay district, 1.2 miles S 80° W of Mooresville. Authority, Chartiers Oil Company. Completed Sept. 3, 1901.

| (Elevation, 960' B-A. T.) | Thickness. Total. |       |
|---------------------------|-------------------|-------|
|                           | Feet.             | Feet. |
| Unrecorded .....          | 555               | 555   |
| Pittsburgh coal .....     |                   | 555   |
| Unrecorded .....          | 1305              | 1860  |
| Big Injun sand.....       | 194               | 2054  |
| Unrecorded .....          | 391               | 2445  |

|   | Thickness. Total. |       |
|---|-------------------|-------|
|   | Feet.             | Feet. |
| Fifty-foot sand .....   | 73                | 2518  |
| Unrecorded .....  | 79                | 2697  |
| Gordon Stray sand.....  | 8                 | 2705  |
| Unrecorded .....  | 81                | 2786  |
| Sand, (Fourth) .....  | 10                | 2796  |
| Unrecorded .....  | 28                | 2824  |
| Sand, (Fifth) .....   | 10                | 2834  |
| Unrecorded .....  | 168               | 3002  |
| Sand, (Bayard) (gas, 3002' and 3012½').....   | 13                | 3015  |
| Slate and shells to bottom.....   | 246               | 3261  |
| 13" casing, 155'; 10" casing, 942'; 8¼" casing, 1442'; 6½" casing, 1600'; 5⅜" casing, 2012'.    |                   |       |
| "Nice flow of gas and increased at 3012½'. Probably make 30 lbs. pressure minute in 5⅜" casing. |                   |       |

**Worley Oil Pool.**—About one mile northeast of Worley in the northern edge of Clay district, the Mooresville anticline dies down northward into a "saddle-like" form, and thereon is found a small oil pool of one-half dozen wells in the Bayard sand. Some of the wells made oil from the Big Injun. The logs of the **Brown Heirs No. 1 (177)** and **Lee R. Shriver No. 1 (176)** are published on pages 234-235 and 235-236, respectively of Vol. I of the State Survey reports. The Brown well had a good showing of oil in the Big Injun, and gas in the Fifth sand; while the Shriver well produced oil and gas from both the Big Injun and Bayard sands. The following records from other wells in this field give much data of interest:

#### John Blair No. 1 Well Record (178).

Clay district, 1 mile N 15° E of Worley. Authority, South Penn Oil Company. Completed in 1896.

|   | Thickness. Total. |       |
|---|-------------------|-------|
|   | Feet.             | Feet. |
| Conductor .....   | 12                | 12    |
| Unrecorded .....  | 526               | 538   |
| Pittsburgh coal .....   |                   | 538   |
| Unrecorded .....  | 1282              | 1820  |
| Big Injun sand (salt water, 1925').....   | 154               | 1974  |
| Unrecorded .....  | 886               | 2860  |
| Dark shells and slate.....  | 92                | 2952  |
| Sixth sand (first pay, 2952').....  | 2                 | 2954  |
| Dark shells and slate.....  | 36                | 2990  |
| "10" casing, 553' 6"; 8¼" casing, 1453'; 6½", 1598' 4"; 5⅜" casing, 1964' 3". 4 to 5 barrel oil show in Sixth or Bayard sand. Abandoned Dec. 10, 1896." |                   |       |

The above was the first well drilled in this field.



## Lee R. Shriver No. 2 Well Record (172).

Clay district, 0.6 mile northeast of Worley. Authority, South Penn Oil Company. Completed December 9, 1897.

| (Elevation, 965' B-A. T.)   | Thickness. Total. |       |
|---|-------------------|-------|
|   | Feet.             | Feet. |
| Unrecorded .....  | 195               | 195   |
| Mt. Morris (Waynesburg) coal.....                                     | ...               | 195   |
| Unrecorded .....  | 259               | 454   |
| Mapletown (Sewickley) coal.....                                       | ...               | 454   |
| Unrecorded .....  | 81                | 535   |
| Pittsburgh coal.....  | ...               | 535   |
| Unrecorded .....  | 150               | 685   |
| Sand .....  | 95                | 780   |
| Blue and red cave.....  | 90                | 870   |
| Shells .....  | 15                | 885   |
| Sand, (Saltsburg).....  | 30                | 915   |
| Slate and shells.....   | 95                | 1010  |
| Little Dunkard sand.....  | 40                | 1050  |
| Slate .....   | 60                | 1110  |
| Coal (Upper Freeport).....  | 2                 | 1112  |
| Slate .....   | 93                | 1205  |
| Coal, (Upper Kittanning).....   | 2                 | 1207  |
| Slate and shells.....   | 73                | 1280  |
| Gas sand.....   | 40                | 1320  |
| Slate .....   | 7                 | 1327  |
| Sand, (II Cow Run).....   | 43                | 1370  |
| Slate .....   | 6                 | 1376  |
| Salt sand (water, 1415').....   | 69                | 1445  |
| Slate and shells.....   | 155               | 1600  |
| Red rock.....   | 65                | 1665  |
| Slate and shells.....   | 40                | 1705  |
| Red rock.....   | 12                | 1717  |
| Little Lime.....  | 38                | 1755  |
| Big Injun sand (gas, 1882'; oil and water, 1903'; water, 1915') ..... | 173               | 1928  |
| Slate .....   | 57                | 1985  |
| Sand, (Squaw).....  | 55                | 2040  |
| Slate and shells.....   | 28                | 2068  |
| Sand and shells.....  | 307               | 2375  |
| Slate and pebbles.....  | 65                | 2440  |
| Sand .....  | 5                 | 2445  |
| Slate and shells.....   | 15                | 2460  |
| Sand, (Gantz) .....   | 20                | 2480  |
| Slate .....   | 25                | 2505  |
| Sand, (Fifty-foot) .....  | 25                | 2530  |
| Slate .....   | 15                | 2545  |
| Sand .....  | 5                 | 2550  |
| Red rock.....   | 5                 | 2555  |
| Sand .....  | 3                 | 2558  |
| Red rock .....  | 12                | 2570  |
| Sand, (Thirty-foot).....  | 70                | 2640  |
| Slate and shells.....   | 20                | 2660  |
| Red rock .....  | 35                | 2695  |
| Sand, (Gordon Stray).....   | 25                | 2720  |
| Shells .....  | 40                | 2760  |

|   | Thickness. | Total |
|---|------------|-------|
|   | Feet.      | Feet. |
| Fourth sand .....   | 15         | 2805  |
| Slate and shells.....   | 35         | 2840  |
| Gordon sand .....   | 8          | 2768  |
| Slate and shells.....   | 22         | 2790  |
| Fifth sand.....   | 5          | 2845  |
| Slate .....   | 57         | 2902  |
| Sand, (Bayard) (oil and gas, 2943'-2949').....  | 47         | 2949  |
| Slate to bottom.....  | 11½        | 2960½ |
| 10" casing, 565' 7"; 8" casing, 1405'; 6½" casing, 1572' 4"; 4" liner, 1018' 3"; 4" inserted casing, 2906'. |            |       |

The above record gives all the main producing sands of the Catskill measures in West Virginia, and shows the formation at 2902' to be the Bayard. Two Allegheny coals are noted; viz., Upper Freeport and Upper Kittanning.

#### Lee R. Shriver No. 3 Well Record (174).

Clay district, 0.8 mile northeast of Worley. Authority, South Penn Oil Company. Completed June 29, 1898.

|   | Thickness. | Total |
|---|------------|-------|
|   | Feet.      | Feet. |
| (Elevation, 975' B-A. T.)   |            |       |
| Conductor .....   | 21         | 21    |
| Unrecorded .....  | 427        | 448   |
| Coal, Mapletown (Sewickley).....  |            | 448   |
| Unrecorded .....  | 92         | 540   |
| Pittsburgh coal .....   |            | 540   |
| Unrecorded .....  | 1250       | 1790  |
| Big Injun sand (gas, 1880'; oil, 1900') and unrecorded to bottom .....                        | 138        | 1928  |
| 10" casing, 568'; 6½" casing, 1560'.  |            |       |
| Shot May 28, 1900 with 10 quarts.   |            |       |
| Shot July 6, 1901, with 16 quarts.  |            |       |
| Shot Sept. 29, 1904, with 10 quarts.  |            |       |
| Drilled deeper Oct. 4, 1904.  |            |       |
| Unrecorded .....  | 496        | 2424  |
| Sand (Gantz) (gas show, 2452') and unrecorded (first oil pay in Bayard, 2927', to bottom..... | 544        | 2968  |
| 5⅝" casing, 1952' 9"; 4" casing, 433' 11"   |            |       |

The above well had an initial oil production of 10-15 bbls. from the Big Injun sand, but it was producing oil from the Bayard in August, 1911, the latter having about the same initial daily production.

### J. O. & E. Price No. 1 Well Record (173).

Clay district, 0.7 mile northeast of Worley. Authority, Jos. McDermott. Completed June 6, 1910.

| (Elevation, 990' B-A. T.)  | Thickness. Total. |       |
|--|-------------------|-------|
|  | Feet.             | Feet. |
| Conductor .....  | 40                | 40    |
| Unrecorded .....   | 512               | 552   |
| Coal, Pittsburgh .....   | 9                 | 561   |
| Unrecorded .....   | 1259              | 1820  |
| Big Injun sand (gas show, 1855'; oil show and water, 1913½") ..... | 230               | 2050  |
| Unrecorded .....   | 335               | 2385  |
| Sand, (Berea, Gantz and Fifty-foot) (gas, small, 2440') .....      | 170               | 2555  |
| Unrecorded .....   | 120               | 2675  |
| Sand, (Gordon) .....   | 40                | 2715  |
| Unrecorded .....   | 120               | 2835  |
| Sand, (Fifth) .....  | 20                | 2855  |
| Unrecorded .....   | 96                | 2951  |
| Sand, (Bayard) .....   | 2                 | 2953  |
| Unrecorded (oil show in slate, 2966') .....                        | 45                | 2998  |
| Bayard sand .....  | 2                 | 3000  |
| Slate and shells to bottom .....                                   | 190               | 3190  |

13" casing, 58', to shut off quicksand; 10" casing, 580'; 8¼" casing, 1396'; 6½" casing, 1585'; 5¾" casing, 1950'.

The above well is drilled on old drainage terrace of Dunkard creek; hence, the large amount—58 feet—of 13" casing required to shut off quicksand.

Southward from Worley along the crest of the Mooresville anticline to just south of Mooresville, there occurs a small gas field consisting of one-half dozen wells. The Big Injun, Fourth, Fifth and Bayard are main producing horizons. The following record gives much data as to the sands and coal beds:

### Etta Core No. 2268 Well Record (171).

Clay district, 0.5 mile southwest of Worley. Authority, Hope Natural Gas Company. Completed Nov. 10, 1911.

| (Elevation, 1345' B-A. T.)                     | Thickness. Total. |       |
|--|-------------------|-------|
|  | Feet.             | Feet. |
| Unrecorded .....                               | 160               | 160   |
| Coal, Jollytown (12 bailers water, 160') ..... | 2                 | 162   |
| Unrecorded .....                               | 198               | 360   |
| Coal, Washington .....                         | 4                 | 364   |
| Unrecorded .....                               | 121               | 485   |
| Coal, Waynesburg .....                         | 5                 | 490   |
| Unrecorded .....                               | 78                | 568   |
| Coal, Uniontown .....                          | 7                 | 575   |
| Unrecorded .....                               | 233               | 808   |

|  | Thickness.<br>Feet.   | Total.<br>Feet. |
|--|-----------------------|-----------------|
| Mapletown (Sewickley) coal.....                                    | 7                     | 815             |
| Unrecorded .....   | 77                    | 892             |
| Pittsburgh coal .....  | 10                    | 902             |
| Unrecorded .....   | 348                   | 1250            |
| Little Dunkard sand.....   | 30                    | 1280            |
| Unrecorded .....   | 110                   | 1390            |
| Big Dunkard sand.....  | 80                    | 1470            |
| Unrecorded .....   | 98                    | 1568            |
| Gas sand (gas, 8/10 mercury in 2" tubing, 1580').....              | 82                    | 1650            |
| Unrecorded .....   | 59                    | 1709            |
| First Salt sand.....   | 26                    | 1735            |
| Unrecorded .....   | 20                    | 1755            |
| Second Salt sand (hole full of water, 1759').....                  | 143                   | 1898            |
| Unrecorded .....   | 157                   | 2055            |
| Little Lime .....  | 15                    | 2070            |
| Pencil cave.....   | 22                    | 2092            |
| Big Lime .....   | 53                    | 2145            |
| Big Injun sand (gas, 8/10 mercury in 2" tubing, 2175'-2185') ..... | 104                   | 2249            |
| Unrecorded .....   | 3                     | 2252            |
| Squaw sand .....   | 130                   | 2382            |
| Unrecorded .....   | 58                    | 2440            |
| Berea sand .....   | 45                    | 2485            |
| Unrecorded (no Gantz sand).....                                    | 293                   | 2778            |
| Fifty-foot sand .....  | 30                    | 2808            |
| Unrecorded .....   | 15                    | 2823            |
| Fifty-foot sand.....   | 22                    | 2845            |
| Unrecorded .....   | 5                     | 2850            |
| Thirty-foot sand .....   | 25                    | 2875            |
| Unrecorded .....   | 149                   | 3024            |
| Gordon Stray sand.....   | 11                    | 3035            |
| Unrecorded .....   | 85                    | 3120            |
| Gordon sand (broken).....  | 15                    | 3135            |
| Unrecorded .....   | 15                    | 3150            |
| Fourth sand .....  | 10                    | 3160            |
| Unrecorded .....   | 9                     | 3169            |
| Sand .....   | 8                     | 3177            |
| Unrecorded .....   | 11                    | 3188            |
| Sand, (Fifth) (gas show, 3190').....                               | 14                    | 3202            |
| Unrecorded .....   | 97                    | 3299            |
| Sand, (gas, 3302').....14'   | } (Bayard sand) ..... | 25              |
| Sand, unrecorded.....2   |                       |                 |
| Sand (oil show, 3318').....9                                       |                       |                 |
| Unrecorded to bottom.....  | 24                    | 3348            |

10" casing, 914'; 8 $\frac{1}{4}$ " casing, 1760'; 6 $\frac{3}{8}$ " casing, 2112'; 5 $\frac{3}{8}$ " casing, 3027'.

The gage test in the Big Injun is equivalent to 500,000 cu. ft. of gas daily. The Bayard oil showing was for about 2 bbls. daily.

**Mt. Morris-Fairview Oil Belt, Clay District.**—This great oil field enters Clay district from the northeast on the head

of Smoky drain, slightly over a mile northeast of Core, bears S 25° W to a point 1.5 miles south of Core, with a width of  $\frac{3}{4}$  to 1 mile, and then suddenly veers to the westward around a structural terrace on the nose of the Mooresville anticline to a point one mile west of Statler Run P. O., where it has a width of almost 3 miles. From the latter point the field again resumes a southwest course to its intersection with the Monongalia-Marion county line, 1.4 miles north of Fairview, maintaining a width in this portion of  $1\frac{1}{2}$  to 2 miles. Within the boundaries of Clay this field has had 440 to 450 producing oil wells largely in the Big Injun and Bayard sands, with the former horizon far in the lead both in the number of wells and in the total amount of oil produced. The Big Injun oil wells occur throughout the length of the belt across the district, but the Bayard wells are confined to that portion of the field southwest of a line joining Daybrook and Sandy. This oil belt was correctly located and followed from the Pennsylvania line throughout its devious course across Monongalia county and also across Marion in 1888 by I. C. White in demonstration of the structural theory of oil and gas which he discovered in 1883.

The four following logs are from wells in that portion of the oil belt northeast of Dolls run, where the production is from the Big Injun sand only:

### C. C. Core No. 7 Well Record (223).

Clay district, 1.1 miles northeast of Core. Authority, South Penn Oil Company. Completed Jan. 1, 1907.

| (Elevation, 1340' B-A. T.)   | Thickness. Total. |       |
|--|-------------------|-------|
|  | Feet.             | Feet. |
| Conductor .....  | 20                | 20    |
| Unrecorded .....   | 756               | 776   |
| Pittsburgh coal .....  |                   | 776   |
| Unrecorded .....   | 1304              | 2080  |
| <b>Big Injun sand (gas, 2163'; oil, 2182') and unrecorded to bottom</b> .....                                      | 129               | 2209  |
| 10" casing; 810' 8 $\frac{1}{4}$ " casing, 1665'; 6 $\frac{5}{8}$ " casing, 1846'; 5 $\frac{3}{8}$ " casing, 243'. |                   |       |

"Shot April 6, 1908, with 10 quarts; 3 $\frac{1}{2}$ "x5' shell. Shot May 3, 1910, with 16 quarts.

The above well had an initial oil production of 10 bbls daily, and in September, 1911, was still making 3 bbls. daily.

**Thos. Sutton No. 2 Well Record (222).**

Clay district, 1 mile northeast of Core. Authority, South Penn Oil Company. Completed about 1889.

|  | Thickness. | Total. |
|--|------------|--------|
| (Elevation, 1365' B-A. T.)                               | Feet.      | Feet.  |
| Unrecorded .....   | 2182       | 2182   |
| First pay (in Big Injun sand) and unrecorded to bottom.. | 46         | 2228   |
| 6¼" casing, 600'; 4¾" casing, 1900'; 4" liner, 261'.     |            |        |

The above well had an initial oil production of 250 bbls. daily, and in September, 1911, was still making 2½ bbls. daily.

**C. C. Core No. 3 Well Record (221).**

Clay district, 1.2 miles northeast of Core. Authority, South Penn Oil Company. Completed Feb. 1, 1895.

|  | Thickness. | Total. |
|--|------------|--------|
| (Elevation, 1440' B-A. T.)   | Feet.      | Feet.  |
| Unrecorded .....   | 860        | 860    |
| Pittsburgh coal .....  |            | 860    |
| Unrecorded .....   | 1300       | 2160   |
| Big Injun sand (break, 2255'-2270') first pay 2270') and unrecorded to bottom..... | 140        | 2300   |
| 10" casing, 880'; 8¼" casing, 907'; 6½" casing, 1901'; 5¾" casing, 2180'.          |            |        |

Shot Feb. 11, 1897, with 3 quarts; Feb. 2, 1899, with 10 quarts; Jan. 6, 1900, with 16 quarts; May 4, 1901, 30 quarts; Aug. 26, 1902, with 40 quarts; April 1, 1905, with 60 quarts.

The above well had an initial oil production of 75 bbls. daily and Sept., 1911, was still making 4 bbls. daily. The lasting qualities of the Big Injun wells in the Mt. Morris-Fairview field are second to none in the State.

**Asa Sutton No. 6 Well Record (220).**

Clay district, 1.2 miles northeast of Core. Authority, South Penn Oil Company. Completed July 27, 1895.

|  | Thickness. | Total. |
|--|------------|--------|
| (Elevation, 1485' B-A. T.)   | Feet.      | Feet.  |
| Conductor .....  | 20         |        |
| Unrecorded .....   | 900        | 920    |
| Pittsburgh coal .....  |            | 920    |
| Unrecorded .....   | 1308       | 2228   |
| Big Injun sand (first oil pay, 2289') and unrecorded to bottom .....       | 132        | 2360   |
| 10" casing, 951'; 8¼" casing, 941'; 6½" casing, 1965½'; 5¾" casing, 2238'. |            |        |

Shot Feb. 11, 1897, with 3 quarts; May 28, 1898, with 10 quarts; and July 20, 1899, with 16 quarts.

"Initial oil production, 75 bbls., but abandoned Nov. 14, 1900."

The **D. E. Lemley No. 1 well (217A)**, located 1 mile southeast of Core on the east edge of the oil belt and drilled in 1890 by E. M. Hukill was the first oil producer to be obtained in this Big Injun pool between Dolls run and the W. Va.-Penna. State line. Its initial production was 10 to 15 bbls. daily.

The two following are the records of wells that were drilled slightly too far northwest down the structural slope to catch the main oil belt in the Big Injun, the result being salt water. The same also happened at the **Kate Core No. 2 well (219)**, located 0.5 mile north of Core:

**(Kate) Benjamin Core No. 1 Well Record (218).**

Clay district, at Core. Authority Chartiers Oil Co. Completed Oct. 17, 1897.

| (Elevation, 949' L-A. T.)   | Thickness. Total. |       |
|---|-------------------|-------|
|   | Feet.             | Feet. |
| Unrecorded .....  | 512               | 512   |
| Pittsburgh coal .....   |                   | 512   |
| Unrecorded .....  | 1268              | 1780  |
| Big Injun sand (oil, 1862' and 1870') and unrecorded to bottom .....      | 129               | 1909  |
| 10" casing, 546'; 8¼" casing, 812'; 6¾" casing, 1543'; 5¾" casing, 1780'. |                   |       |

"First pay, little oil, gas and salt water; second pay, big dose of salt water, filled up 1200' in short time."

**M. C. Wildman No. 1123 Well Record (217).**

Clay district, 0.6 mile southwest of Core. Authority, Hope Natural Gas Company. Completed April 24, 1909.

| (Elevation, 1130' B-A. T.)                              | Thickness. Total. |       |
|---|-------------------|-------|
|   | Feet.             | Feet. |
| Conductor .....   | 14                | 14    |
| Unrecorded .....  | 302               | 316   |
| Coal, native (Waynesburg) .....                         | 5                 | 321   |
| Unrecorded .....  | 354               | 675   |
| Pittsburgh coal, (steel line measurement) .....         | 8                 | 683   |
| Unrecorded .....  | 287               | 970   |
| Sand, (Moundsville) .....                               | 30                | 1000  |
| Unrecorded .....  | 150               | 1150  |
| Sand, (I Cow Run) .....                                 | 20                | 1170  |
| Unrecorded .....  | 36                | 1206  |
| Sand, Big Dunkard .....                                 | 34                | 1240  |
| Unrecorded .....  | 86                | 1326  |
| Gas sand (steel line measurement) .....                 | 20                | 1346  |
| Unrecorded .....  | 154               | 1500  |
| Sand, (II Cow Run) (15 ten-foot bailers of water) ..... | 20                | 1520  |
| Unrecorded .....  | 38                | 1558  |

|  | Thickness. | Total.      |
|--|------------|-------------|
|  | Feet.      | Feet.       |
| Salt sand .....  | 42         | 1600        |
| Unrecorded .....   | 33         | 1633        |
| Salt sand and unrecorded.....  | 107        | 1740        |
| Maxton sand.....   | 60         | 1800        |
| Unrecorded .....   | 64         | 1864        |
| Little Lime .....  | 20         | 1884        |
| Pencil cave .....  | 2          | 1886        |
| Big Lime .....   | 44         | 1930        |
| <b>Big Injun sand (2 bailers of water; gas and oil, 2050'; steel line measurement) .....</b> | <b>179</b> | <b>2109</b> |
| Unrecorded .....   | 41         | 2150        |
| Squaw sand .....   | 20         | 2170        |
| Unrecorded .....   | 340        | 2510        |
| Sand, (Berea) .....  | 35         | 2545        |
| Unrecorded .....   | 23         | 2568        |
| Sand, (Gantz) .....  | 27         | 2595        |
| Unrecorded .....   | 5          | 2600        |
| Fifty-foot sand (steel line measurement).....  | 25         | 2625        |
| Unrecorded .....   | 29         | 2654        |
| Red rock .....   | 6          | 2660        |
| Thirty-foot sand.....  | 15         | 2675        |
| Unrecorded .....   | 125        | 2800        |
| Gordon Stray sand .....  | 5          | 2805        |
| Unrecorded .....   | 30         | 2835        |
| Sand, hard, (Gordon) .....   | 15         | 2850        |
| Unrecorded .....   | 62         | 2912        |
| Sand, (Fourth).....  | 7          | 2919        |
| Unrecorded .....   | 31         | 2950        |
| Sand, (Fifth) .....  | 22         | 2972        |
| Unrecorded .....   | 96         | 3068        |
| Sand .....   | 4          | 3072        |
| Unrecorded .....   | 2          | 3074        |
| Sand, (Bayard) (steel line measurement).....   | 4          | 3078        |
| Unrecorded .....   | 152        | 3230        |
| Sand, (Elizabeth) (steel line measurement).....  | 20         | 3250        |
| Unrecorded to bottom.....  | 85         | 3335        |

Shot April 27, 1909, in Big Injun with 30 quarts of nitro-glycerine; 8' shell; top of shell, 2048'.

10" casing, 694'; 8 $\frac{1}{4}$ " casing, 1608'; 6 $\frac{5}{8}$ " casing, 1893'; 5 $\frac{1}{2}$ " casing, 2803'.

The well was abandoned as dry hole.

The five following records are from one of the richest portions of this great oil belt southeastward from Pedlar and northeastward from Behler. The shot records show that the wells require attention in this respect about every two years, with a gradual increase in the amount of nitro-glycerine used in the charge:



### C. E. Johnson No. 5 Well Record (216).

Clay district, 1.1 miles south of Core. Authority, South Penn Oil Company. Completed Sept. 21, 1891.

|  | Thickness. Total. |       |
|--|-------------------|-------|
|  | Feet.             | Feet. |
| (Elevation, 1325' B-A. T.)   |                   |       |
| Unrecorded .....   | 820               | 820   |
| <b>Pittsburgh coal</b> .....   |                   | 820   |
| Unrecorded .....   | 1285              | 2105  |
| <b>Big Injun sand</b> (first pay, 2177'; second, 2186') and unrecorded to bottom.....  | 96                | 2201  |
| 10" casing, 853'; 8¼" casing, 1515'; 5⅜" casing, 2064'.  |                   |       |
| Shot Aug. 28, 1897, with 5 quarts; Aug. 29, 1899, with 10 quarts; July 31, 1901, with 24 quarts; Feb. 18, 1904, with 40 quarts; and May 3, 1906, with 50 quarts. |                   |       |

The above well had an initial oil production of 150 bbls. daily, but in September, 1911, was making only 1½ bbls. daily.

### C. E. Johnson No. 1 Well Record (215).

Clay district, 1.2 miles south of Clay. Authority, South Penn Oil Company. Completed about 1889.

|  | Thickness. Total. |       |
|--|-------------------|-------|
|  | Feet.             | Feet. |
| (Elevation, 1340' B-A. T.)   |                   |       |
| Unrecorded (first oil pay in Injun, 2185') to bottom.....                                  | 2218              | 2218  |
| 7⅝" casing, 805'; 4⅞" casing, 1855'. 4" liner, 2217'-2153'.                                |                   |       |
| "Initial oil production, 60 bbls. daily, but making only ½ bbl. daily in September, 1911." |                   |       |

### C. E. Johnson No. 8 Well Record (214).

Clay district, 0.8 mile southeast of Pedlar. Authority, South Penn Oil Company. Completed in 1906.

|   | Thickness. Total. |       |
|---|-------------------|-------|
|   | Feet.             | Feet. |
| (Elevation, 1280' B-A. T.)  |                   |       |
| Unrecorded .....  | 330               | 330   |
| Bluff sand .....  | 85                | 415   |
| Unrecorded .....  | 265               | 680   |
| Coal, Mapletown (Sewickley) and unrecorded.....   | 90                | 770   |
| Coal, Pittsburgh .....  |                   | 770   |
| Unrecorded .....  | 390               | 1160  |
| Little Dunkard sand.....  | 15                | 1175  |
| Unrecorded .....  | 790               | 1965  |
| Big Lime .....  | 98                | 2063  |
| <b>Big Injun sand</b> (first oil pay, 2062'; second, 2163') and unrecorded to bottom..... | 117               | 2180  |

Although the above well is located in the middle portion of the oil belt, its initial oil production was only 1 bbl. daily, and was making ¼ bbl. daily in September, 1911. Its low

initial output may be due to the gradual exhaustion of the oil pays by other surrounding wells drilled 12 to 15 years previously.

### Simon Wildman No. 15 Well Record (213).

Clay district, 1 mile northeast of Behler. Authority, South Penn Oil Company. Completed June 24, 1893.

| (Elevation, 1035' L-A. T.)   | Thickness. Total. |       |
|--|-------------------|-------|
|  | Feet.             | Feet. |
| Unrecorded .....   | 505               | 505   |
| Pittsburgh coal .....  |                   | 505   |
| Unrecorded .....   | 1295              | 1800  |
| Big Injun sand (pay, 1896') and unrecorded to bottom....   | 126½              | 1926½ |
| 10" casing, 520'; 8¼" casing, 800'; 6½" casing, 1520'; 5½" casing, 300'; 4½" casing, with Masseth Packer, 1516'. |                   |       |
| Shot Feb. 9, 1897, with 3 quarts; July 8, 1898, with 10 quarts; and Nov. 29, 1899, with 16 quarts.               |                   |       |

### D. E. Cordray No. 4 Well Record (212).

Clay district, at Behler. Authority, South Penn Oil Company. Completed Sept. 24, 1895.

| (Elevation, 1391' L-A. T.)   | Thickness. Total. |       |
|--|-------------------|-------|
|  | Feet.             | Feet. |
| Conductor .....  | 14                | 14    |
| Unrecorded .....   | 791               | 805   |
| Pittsburgh coal .....  |                   | 805   |
| Unrecorded .....   | 1330              | 2135  |
| Big Injun sand (first pay, show, 2221'; second pay, good, 2239') and unrecorded to bottom..... | 124               | 2259  |
| 10" casing, 836' 8"; 8¼" casing, 946' 9"; 6½" casing, 1865'; 5½" casing, 2145'.                |                   |       |

Shot Jan. 30, 1897, with 3 quarts; Mar. 19, 1898, with 10 quarts; May 12, 1900, with 20 quarts; and Mar. 21, 1903, with 30 quarts.

The following is the record of a well on the terrace around the nose of the Mooresville anticline. The driller has erroneously correlated the Sewickley coal with the Pittsburgh bed, since the latter belongs about 1340 feet above the top of the Big Injun sand in this region. Taking into consideration the elevation of the well, structure would place the Pittsburgh seam nearly 100 feet lower.

**D. J. Eddy No. 3 Well Record (210).**

Clay district, 1 mile southeast of Statler Run. Authority, South Penn Oil Company. Completed Apr. 29, 1892.

|  | Thickness. Total. |       |
|--|-------------------|-------|
| (Elevation, 1090' B-A. T.)   | Feet.             | Feet. |
| Unrecorded .....   | 445               | 445   |
| Coal, Pittsburgh (Sewickley).....  |                   | 445   |
| Unrecorded .....   | 1425              | 1870  |
| Big Injun sand (first pay, 1926'; second, 1941') and unrecorded to bottom..... | 86                | 1956  |
| 10" casing, 558'; 8¼" casing, 1069'; 6½" casing, 1564'; 5⅝" casing, 1850'.     |                   |       |

Shot June 19, 1893, with 16 quarts; Aug. 21, 1900, with 20 quarts; Dec., 1902, with 30 quarts; and Apr. 2, 1909, with 40 quarts.

The following is the record of light gasser in the Bayard, which was evidently dry in the Big Injun. It had been abandoned for sometime in 1911:

**Daniel Moore No. 2 Well Record (208).**

Clay district, 1.3 miles northeast of Statler Run. Authority, Chartiers Oil Company. Completed May 27, 1899.

|   | Thickness. Total.     |       |
|---|-----------------------|-------|
| (Elevation, 1070' B-A. T.)                              | Feet.                 | Feet. |
| Unrecorded .....  | 572                   | 572   |
| Pittsburgh coal .....                                   |                       | 572   |
| Unrecorded (gas, 1282').....                            | 2448                  | 3020  |
| Sand, (Bayard) (gas, 3025½') and unrecorded to bottom.. | 25½                   | 3045½ |
| Pressure test:  |                       |       |
| 1st minute, 40 lbs.                                     | 10th minute, 175 lbs. |       |
| 5th minute, 105 lbs.                                    |                       |       |
| 10" casing, 582'; 8¼" casing, 864'; 6½" casing, 1630'.  |                       |       |

As mentioned on a preceding page, the widest and richest portion of the Big Injun production of the Mt. Morris-Fairview oil belt occurs on the waters of Statler run. The eight following records from wells on the latter stream give interesting data:

**Minor Tennant No. 1 Well Record (207).**

Clay district, 0.8 mile north of Statler Run. Authority, Chartiers Oil Company. Completed Mar. 31, 1896.

|   | Thickness. Total. |       |
|---|-------------------|-------|
| (Elevation, 970' B-A. T.)   | Feet.             | Feet. |
| Unrecorded .....  | 480               | 480   |
| Pittsburgh coal .....   |                   | 480   |
| Unrecorded .....  | 1335              | 1815  |
| Big Injun sand (oil pay, 1881'-1884').....                                |                   |       |
| 10" casing, 493'; 8¼" casing, 835'; 6½" casing, 1485'; 5⅝" casing, 1815'. |                   |       |

The above well had an initial oil production of 600 bbls. daily from the Big Injun, and was still making 6 bbls. daily in August, 1911. It is now owned and operated by Hon. Jos. H. McDermott of Morgantown, who, by keeping the shot cavity entirely filled with oil after cleaning out—thus preventing in a large measure the accumulation of paraffine on its walls—has practically doubled the oil production in this and other wells in the immediate neighborhood.

### Mary E. Tennant No. 1 Well Record (206).

Clay district, 0.5 mile north of Statler Run. Authority, Jos. McDermott. Completed about 1896.

|   | Thickness. Total. |       |
|---|-------------------|-------|
|   | Feet.             | Feet. |
| (Elevation, 985' L-A. T.)                                 |                   |       |
| Unrecorded .....  | 475               | 475   |
| Pittsburgh coal .....                                     | ...               | 475   |
| Unrecorded .....  | 1321              | 1796  |
| Big Injun sand (oil pay, 1877') and unrecorded to bottom. | 96                | 1892  |
| 10" casing, 485'; 8" casing, 840'; 6" casing, 1510'.      |                   |       |

The above well had an initial oil production of 65 bbls. daily from the Big Injun sand, but was making only 1½ bbls. daily in August, 1911. The oil pay in this region, according to Noah Moore, foreman for J. H. McDermott, comes 85 feet below the top of the sand, and frequently a pay of gas, 10 to 12 feet higher.

### Asa Tennant No. 9 Well Record (204).

Clay district at Statler Run P. O. Authority, Hon. Jos. H. McDermott. Completed Nov. 1, 1907.)

|  | Thickness. Total. |       |
|--|-------------------|-------|
|  | Feet.             | Feet. |
| (Elevation, 1019' L-A. T.)   |                   |       |
| Unrecorded .....   | 493               | 493   |
| Pittsburgh coal .....  | ...               | 493   |
| Unrecorded .....   | 1307              | 1800  |
| Big Injun sand (oil pay, 1901') and unrecorded to bottom.                  | 125½              | 1925½ |
| 10" casing, 507'; 8¼" casing, 1302'; 6⅝" casing, 1520'; 5¾" casing, 1804'. |                   |       |

"Initial production, 5 bbls. daily, and still making 2 bbls. daily in September, 1911."

According to Noah Moore, foreman, the Big Lime (Greenbrier Limestone) is only 20 to 25 feet thick in this and other wells in the neighborhood.

### Mahala McCord Heirs No. 1 Well Record (202).

Clay district, 1.1 miles east of Daybrook. Authority, Chartiers Oil Company.

| (Elevation,, 1350' B-A. T.)                              | Thickness. Total |       |
|--|------------------|-------|
|  | Feet.            | Feet. |
| Unrecorded .....   | 905              | 905   |
| Pittsburgh coal .....                                    | ..               | 905   |
| Unrecorded .....   | 1315             | 2220  |
| Big Injun sand (small show oil, 2326') .....             | 180              | 2400  |
| Slate and shells .....                                   | 60               | 2460  |
| Dark gray sand, very hard (Squaw) .....                  | 30               | 2490  |
| Light slate and shells .....                             | 190              | 2680  |
| Light slate with hard shells in bottom .....             | 32               | 2712  |
| Sand, very dark and hard .....                           | 17               | 2729  |
| Slate, light .....                                       | 30               | 2759  |
| Dark slate and shells .....                              | 9                | 2768  |
| Dark gray sand (small gas show) (Berea) .....            | 8                | 2776  |
| Soft slate and shells .....                              | 19               | 2795  |
| Sand, very dark and hard .....                           | 25               | 2820  |
| Slate, light, soft .....                                 | 12               | 2832  |
| Sand, dark and hard (Gantz and Fifty-foot) .....         | 90               | 2922  |
| Slate, reddish brown .....                               | 5                | 2927  |
| Sand, reddish brown, hard .....                          | 16               | 2943  |
| Soft slate and shells .....                              | 23               | 2966  |
| Sand, dark, hard (Thirty-foot) .....                     | 10               | 2976  |
| Red rock and light shells .....                          | 14               | 2990  |
| Sand, bastard, soft dark red .....                       | 22               | 3012  |
| Red slate with shells .....                              | 16               | 3028  |
| Sand, hard, dark, with soft streaks (Gordon Stray) ..... | 21               | 3049  |
| Light slate with shells .....                            | 27               | 3076  |
| Slate, bright red .....                                  | 24               | 3100  |
| Sand, soft, dark (Gordon) .....                          | 8                | 3108  |
| Slate, red, soft, with shells .....                      | 15               | 3123  |
| Sand, hard, dark .....                                   | 9                | 3132  |
| Slate, soft, red .....                                   | 3                | 3135  |
| Sand, hard, dark gray .....                              | 9                | 3144  |
| Slate, soft red .....                                    | 5                | 3149  |
| Sand, hard, shells and slate..21' } (Fourth) .....       | 48               | 3197  |
| Sand, bastard, dark gray....27' }                        |                  |       |
| Slate, light red .....                                   | 8                | 3205  |
| Dark sand and shells (Fifth) .....                       | 40               | 3245  |
| Hard sand and shells .....                               | 100              | 3345  |
| Sand (Bayard), gas at bottom .....                       | 5                | 3350  |
| Dark slate and shells to bottom .....                    | 178              | 3528  |

The above well was drilled slightly too far northwest down the structural slope to catch the main oil belt in the Big Injun, but a flow of gas was encountered in the Bayard sand. The Noah Brewer No. 1 well (203), located less than one-fifth mile eastward, had an initial oil production of 30 bbls. daily when completed about November, 1910, and was making 4½ bbls. daily Sept. 1, 1911.

In this region the **Joseph Varner farm** was considered the best in the field, since only one dry hole in 17 wells drilled was obtained, **No. 5 (201)** on this tract starting off Feb. 11, 1895, with an oil production of 750 bbls., and still making 3 bbls. daily in August, 1911.

### Enoch Tennant No. 1 Well Record (198).

Clay district, 1.9 miles southwest of Statler Run. Authority, South Penn Oil Company. Completed February 9, 1894.

|  | Thickness. | Total. |
|--|------------|--------|
|  | Feet.      | Feet.  |
| Conductor .....  | 32         | 32     |
| Unrecorded .....   | 992        | 1024   |
| <b>Pittsburgh coal</b> .....   |            | 1024   |
| Unrecorded .....   | 1306       | 2330   |
| <b>Big Injun sand</b> (first pay, 2417½'; second pay, good, 2422') and unrecorded to bottom..... | 113½       | 2443½  |
| 10" casing, 1053'; 8¼" casing, 826'; 6½" casing, 2060', 5⅝" casing, 2306'.                       |            |        |

The above well had a large initial oil production from the Big Injun, and was still pumping on Sept. 1, 1911.

### Simeon Tennant No. 12 Well Record (196).

Clay district, 0.9 mile northeast of Sandy. Authority, South Penn Oil Company. Completed Feb. 11, 1895.

|  | Thickness. | Total. |
|--|------------|--------|
|  | Feet.      | Feet.  |
| (Elevation, 1195' B-A. T.)   |            |        |
| Conductor .....  | 15         | 15     |
| Unrecorded .....   | 570        | 585    |
| <b>Pittsburgh coal</b> .....   |            | 585    |
| Unrecorded .....   | 1315       | 1900   |
| <b>Big Injun sand</b> (first pay, 1990½') and unrecorded to bottom .....   | 111        | 2011   |
| Shot Mar. 12, 1897, with 10 quarts; Feb. 25, 1898, with 12 quarts; Nov. 7, 1898, with 20 quarts; Oct. 31, 1899, with 30 quarts; Sept. 20, 1901, with 35 quarts; and January, 1903, with 40 quarts. |            |        |

The above well had an initial oil production of 240 bbls. daily, but in August, 1911, was making only 7½ bbls. weekly.

### Presley Tennant No. 7 Well Record (195).

Clay district, 0.4 mile northeast of Sandy. Authority, South Penn Oil Company. Completed May 27, 1895.

|                            | Thickness. | Total. |
|----------------------------|------------|--------|
|                            | Feet.      | Feet.  |
| (Elevation, 1165' B-A. T.) |            |        |
| Conductor .....            | 22         | 22     |
| Unrecorded .....           | 555        | 577    |

|   | Thickness. | Total. |
|---|------------|--------|
|   | Feet.      | Feet.  |
| <b>Pittsburgh coal</b> .....  | 577        | 577    |
| <b>Unrecorded</b> .....   | 1323       | 1900   |
| <b>Big Injun sand</b> (first pay, light, 1960'; second pay, good, 1971') and unrecorded to bottom .....   | 87         | 1987   |
| 10" casing, 586'; 8¼" casing, 885'; 6¾" casing, 1599'; 5⅝" casing, 1860'.   |            |        |
| Shot Mar. 26, 1897, with 10 quarts; Mar. 10, 1898, with 12 quarts; Feb. 20, 1899, with 20 quarts; Apr. 25, 1901, with 30 quarts; Mar. 6, 1902, with 40 quarts; June 4, 1904, with 48 quarts; Mar. 16, 1909, with 60 quarts in 3 shells, 4¼"x6'9". |            |        |
| Top of first shot, 1972'; top of second, 1971'; top of third, 1970'.  |            |        |

### Arthela (James) Eddy No. 5 Well Record (189).

Clay district, 0.3 mile southwest of Sandy. Authority, South Penn Oil Company. Completed Sept. 1, 1894.

|  | Thickness. | Total. |
|--|------------|--------|
|  | Feet.      | Feet.  |
| (Elevation, 1310' B-A. T.)   |            |        |
| <b>Conductor</b> .....   | 32         | 32     |
| <b>Unrecorded</b> .....  | 684        | 716    |
| <b>Pittsburgh coal</b> .....   |            | 716    |
| <b>Unrecorded</b> .....  | 1215       | 1931   |
| <b>Big Injun sand</b> (first pay, 2111') and unrecorded to bottom .....  | 204        | 2135   |
| 10" casing, 727'; 8¼" casing, 781'; 6¾" casing, 1762'; 5⅝" casing, 255'. |            |        |

Shot Apr. 27, 1895, with 5 quarts; June 20, 1896, with 4 quarts; May 7, 1897, with 10 quarts; Nov. 7, 1898, with 20 quarts; Oct. 23, 1899, with 30 quarts; May, 1902, with 35 quarts; and Mar. 8, 1907, with two 20 quart shots, top, 2106'.

Southwestward from the divide between the headwaters of Statler and Days runs to the Monongalia-Marion county line, many of the wells have produced oil from both the Big Injun and Bayard sands. The following records give much data of interest concernig both horizons:

### E. J. Ammons Heirs No. 7 Well Record (193).

Clay district, 2 miles south of Daybrook. Authority, Delmar Oil Company. Completed Apr. 10, 1906.

|                              | Thickness. | Total. |
|------------------------------|------------|--------|
|                              | Feet.      | Feet.  |
| (Elevation, 1160' B-A. T.)   |            |        |
| <b>Conductor</b> .....       | 8          | 8      |
| <b>Unrecorded</b> .....      | 670        | 678    |
| <b>Pittsburgh coal</b> ..... | 6          | 684    |
| <b>Unrecorded</b> .....      | 1296       | 1980   |
| <b>Big Injun sand</b> .....  | 160        | 2140   |
| <b>Unrecorded</b> .....      | 770        | 2910   |
| <b>Fourth sand</b> .....     | 30         | 2940   |

|   | Thickness.<br>Feet. | Total.<br>Feet. |
|---|---------------------|-----------------|
| Unrecorded .....  | 141                 | 3081            |
| Sand (Bayard) (oil and gas, 3082').....   | 7                   | 3088            |
| Unrecorded to bottom.....   | 5                   | 3093            |
| 13" casing, 116'; 10" casing, 690'; 8¼" casing, 978'; 6½" casing, 1664'; 5⅜" casing, 1950'. |                     |                 |

### Daniel L. Toothman No. 12 Well Record (191).

Clay district, 1.5 miles N 85° W of Sandy. Authority, South Penn Oil Company. Completed Aug. 16, 1904.

| (Elevation, 1660' L-A. T.)   | Thickness.<br>Feet. | Total.<br>Feet. |
|--|---------------------|-----------------|
| Conductor .....  | 14                  | 14              |
| Unrecorded .....   | 1229                | 1243            |
| Pittsburgh coal.....   | 8                   | 1251            |
| Unrecorded .....   | 514                 | 1765            |
| Dunkard sand.....  | 40                  | 1805            |
| Unrecorded .....   | 325                 | 2130            |
| Salt sand.....   | 140                 | 2270            |
| Unrecorded .....   | 150                 | 2420            |
| Maxton sand.....   | 15                  | 2435            |
| Unrecorded .....   | 55                  | 2490            |
| Big Lime.....  | 60                  | 2550            |
| Big Injun sand (gas, 2640'; first oil pay, 2640'; second, 2658') .....                       | 130                 | 2680            |
| Unrecorded .....   | 460                 | 3140            |
| Sand, (Gantz and Fifty-foot).....  | 170                 | 3310            |
| Unrecorded .....   | 130                 | 3440            |
| Gordon sand.....   | 50                  | 3490            |
| Unrecorded .....   | 10                  | 3500            |
| Fourth sand.....   | 25                  | 3525            |
| Unrecorded .....   | 138                 | 3663            |
| Fifth sand (oil pay, 3663').....   | 8                   | 3671            |
| Unrecorded to bottom.....  | 28                  | 3699            |
| 10" casing, 1270'; 8¼" casing, 1610'; 6½" casing, 2265'; 5⅜" casing, 2670'; 4" casing, 420'. |                     |                 |

Shot Sept. 10, 1904, with 20 quarts in 10' shell in Fifth (Bayard) sand. Lined with 4" liner at 3648'. Drilled to Injun sand May, 1910. First plug (3, ½" x 4, ⅞") driven to 3215' and filled up 120' with rock and sediment. Second plug (3, ½" x 4, ⅞") driven on top, that is, 3095' and filled up 30' with rock. Third plug (pole 8' long) driven to 2745' and filled up 60' with rock. 5⅜" casing put back with Heeter wall packer set in Big Lime at 2522'.

The above well is probably the deepest oil producer in the Appalachian field, being 68 feet deeper than Wilson Heirs No. 9 in the same region, given as the deepest producing oil well on page 141 of Vol. I(A) of the State Survey reports to the date of the latter's publication, and 41 feet deeper than Wilson Heirs No. 11 (182), located 2 miles north of Fair-



view, completed in 1905 and given as the deepest producing oil well in the world in Bulletin 298 of the U. S. Geological Survey, pp. 292-293. The log of the latter well is also published on the pages last mentioned, and thereon is shown to have had an initial oil production of 12 barrels daily from the Bayard, erroneously called the Fifth sand, along with an oil showing in both the Big Injun and Fifty-foot.

### M. A. Ammons No. 3 Well Record (185).

Clay district, 1.6 miles southwest of Sandy. Authority, South Penn Oil Company. Completed Sept. 10, 1893.

|   | Thickness. Total |       |
|---|------------------|-------|
|   | Feet.            | Feet. |
| (Elevation, 1082' L-A. T.)  |                  |       |
| Conductor .....   | 16               | 16    |
| Unrecorded .....  | 559              | 575   |
| Pittsburgh coal.....  |                  | 575   |
| Unrecorded .....  | 1310             | 1885  |
| Big Injun sand (oil pay, 1982', 1991') and unrecorded to bottom .....       | 127              | 2012  |
| 10" casing, 616'; 8¼" casing, 804' 2"; 6¾" casing, 1607'; 5½" casing, 275'. |                  |       |

Shot Aug. 23, 1895, with 12 quarts; Oct. 27, 1897, with 24 quarts; Mar. 11, 1899, with 30 quarts; and July 2, 1907, with 40 quarts. Top of 30 quart shell, 1988'; top of 10 quart shell, 1980'.

### C. M. Toothman No. 4 Well Record (183).

Clay district, 1.5 miles north of Fairview. Authority, Fisher Oil Company. Completed Dec. 14, 1903.

|  | Thickness. Total |       |
|--|------------------|-------|
|  | Feet.            | Feet. |
| (Elevation, 1055' B-A. T.)   |                  |       |
| Conductor .....  | 10               | 10    |
| Unrecorded .....   | 560              | 570   |
| Pittsburgh coal.....   | 8                | 578   |
| Unrecorded .....   | 1317             | 1895  |
| Big Injun sand (pay, 1969'-1973').....                                     | 120              | 2015  |
| Unrecorded .....   | 765              | 2780  |
| Gordon sand.....   | 20               | 2800  |
| Unrecorded .....   | 30               | 2830  |
| Fourth sand.....   | 30               | 2860  |
| Unrecorded .....   | 121              | 2981  |
| Bayard sand (pay, 2981'-2985').....  | 4                | 2985  |
| Unrecorded to bottom.....  | 18               | 3003  |
| 10" casing, 580'; 8¼" casing, 1075'; 6¾" casing, 1560'; 5½" casing, 1985'. |                  |       |

"4" liner, 535', in two sections, 271 feet in first, and 252' in second, bottom joint perforated. Filled up 800' with oil and water from Injun pay. Filled up 1200' with oil from Bayard sand, the first 12 hours no gas at all. Bottom hole packed put in with 5½" casing. Shot Mar. 26, 1904 with 24 quarts nitro-glycerine; depth before being

shot 2981', after shot 2997'. Making 2 bbls. daily from Bayard when water broke in from Big Injun in June, 1911, temporarily drowning out the well."

The **C. M. Toothman No. 1 well (184)**, located 1.3 miles north of Fairview, had an initial oil production of 30 barre'ts when completed in 1902, and was still making 3 barrels daily in August, 1911.

**W. R. Shuman No. 4 Well Record (181).**

Clay district, 2.2 miles N 50° E of Fairview. Authority, South Penn Oil Company. Completed October 9, 1903.

| (Elevation, 1335' B-A. T.)   | Thickness. Total. |       |
|--|-------------------|-------|
|  | Feet.             | Feet. |
| Conductor .....  | 14                | 14    |
| Unrecorded .....   | 918               | 932   |
| Pittsburgh coal.....   | ..                | 932   |
| Unrecorded .....   | 1300              | 2232  |
| Big Injun sand (water, 2332') and unrecorded.....  | 650               | 2882  |
| Fifty-foot sand and unrecorded.....  | 260               | 3142  |
| Gordon sand and unrecorded.....  | 209               | 3351  |
| Sand (Bayard) (first pay, light, 3351') and unrecorded to bottom .....   | 31                | 3382  |
| 13¼" casing, 98'; 10" casing, 946'; 8¼" casing, 1396'; 6½" casing, 1940'; 5⅞" casing, 2345'; 4½" casing, 471'. |                   |       |

Shot Dec. 22, 1903, with 20 quarts; Feb. 24, 1909, with 40 quarts, 4¼" x 6' 9" shell. Top of first shell, 3352'; top of second, 3351'.

**E. B. Toothman No. 1 Well Record (180).**

Clay district, 1.8 miles north of Fairview. Authority, Pure Oil Company. Completed Oct. 22, 1903.

| (Elevation, 1110' B-A. T.)             | Thickness. Total. |       |
|--|-------------------|-------|
|  | Feet.             | Feet. |
| Unrecorded .....                       | 676               | 676   |
| Pittsburgh coal.....                   | ..                | 676   |
| Unrecorded .....                       | 1300              | 1976  |
| Big Injun sand (pay, 2081'-2086')..... | 138               | 2114  |
| Unrecorded to bottom.....              | 1                 | 2115  |

"Plugged off (Bayard) sand in August, 1906. First plug, 2165'. Stone and sand to 2135'; ½ barrel cement. Wall packer on bottom of 5⅞" casing.'

The above well was drilled on down to the Bayard, having an initial oil production of 10 to 15 barrels from this sand and 10 to 15 barrels in the Big Injun. It was still making 6 barrels from the latter sand in August, 1911.

Oil Days run, 1.7 miles northward from the above well,

there occurs a small oil producer in the Bayard sand; viz., **David L. Ammons No. 1 (192)**, drilled in, about 1903. It had an initial oil production of 5 barrels daily, and was making 3 barrels daily in August, 1911.

Along the southeast edge of Clay district there are several gas wells on the head of Dolls run in which the Big Injun, Gantz and Fifth sands are the producing horizons. The two following records therefrom give the detailed rock succession and other data of interest:

### Martha A. Miller No. 1 Well Record (230).

Clay district, 2.2 miles northeast of Hagans. Authority, West Virginia Traction & Electric Company.

| (Elevation, 1225' B-A. T.)        | Thickness.<br>Feet. | Total.<br>Feet. |
|-----------------------------------|---------------------|-----------------|
| Conductor .....                   | 18                  | 18              |
| Slate and shale.....              | 40                  | 58              |
| Lime .....                        | 7                   | 65              |
| Slate and shale.....              | 50                  | 115             |
| Lime shells .....                 | 20                  | 136             |
| Slate .....                       | 25                  | 160             |
| Slate and sand shale.....         | 50                  | 210             |
| Mt. Morris (Waynesburg) coal..... | 6                   | 216             |
| Slate and shale.....              | 37                  | 253             |
| Lime .....                        | 11                  | 264             |
| Slate .....                       | 24                  | 288             |
| Lime shells.....                  | 23                  | 311             |
| Slate .....                       | 17                  | 328             |
| Sand .....                        | 15                  | 343             |
| Slate and shale.....              | 22                  | 365             |
| Lime .....                        | 11                  | 376             |
| Slate and shale.....              | 19                  | 395             |
| Lime .....                        | 26                  | 421             |
| Slate .....                       | 16                  | 437             |
| Lime .....                        | 7                   | 444             |
| Slate .....                       | 18                  | 462             |
| Lime .....                        | 16                  | 478             |
| Slate .....                       | 10                  | 488             |
| Mapletown (Sewickley) coal.....   | 6                   | 494             |
| Slate and shale.....              | 32                  | 526             |
| Lime .....                        | 12                  | 538             |
| Slate .....                       | 14                  | 552             |
| Lime .....                        | 18                  | 570             |
| Slate .....                       | 7                   | 577             |
| Pittsburgh coal.....              | 8                   | 585             |
| Slate .....                       | 12                  | 597             |
| Sand, (Lower Pittsburgh).....     | 39                  | 636             |
| Slate and shale.....              | 40                  | 676             |
| Sand, (Minshall).....             | 20                  | 696             |
| Slate .....                       | 74                  | 770             |

|  | Thickness. | Total. |
|--|------------|--------|
|  | Feet.      | Feet.  |
| Sand, (Murphy).....                      | 35         | 805    |
| Lime shales.....                         | 50         | 855    |
| Sand, (Grafton).....                     | 35         | 890    |
| Sandy lime.....                          | 25         | 915    |
| Red rock.....                            | 5          | 920    |
| Slate.....                               | 20         | 940    |
| Sand, (Saltsburg).....                   | 15         | 955    |
| Slate and shale.....                     | 90         | 1045   |
| Limy sand.....                           | 25         | 1070   |
| Slate.....                               | 30         | 1100   |
| Red rock.....                            | 15         | 1115   |
| Slate and shale.....                     | 75         | 1190   |
| Big Dunkard sand.....                    | 35         | 1225   |
| Lime.....                                | 25         | 1250   |
| Sand.....                                | 20         | 1270   |
| Slate.....                               | 25         | 1295   |
| Sand.....                                | 5          | 1300   |
| Slate and shale.....                     | 30         | 1330   |
| Sand.....                                | 12         | 1345   |
| Slate.....                               | 25         | 1370   |
| Sand.....                                | 25         | 1395   |
| Slate.....                               | 32         | 1427   |
| Salt sand.....                           | 80         | 1507   |
| Slate.....                               | 28         | 1535   |
| Sand.....                                | 35         | 1570   |
| Black slate.....                         | 10         | 1580   |
| Limy sand.....                           | 19         | 1599   |
| Slate.....                               | 45         | 1644   |
| Limy sand.....                           | 40         | 1684   |
| Slate.....                               | 20         | 1704   |
| Red rock.....                            | 28         | 1732   |
| Limy sand.....                           | 17         | 1749   |
| Slate.....                               | 11         | 1760   |
| Red rock.....                            | 14         | 1774   |
| Slate.....                               | 12         | 1786   |
| Limy sand.....                           | 9          | 1795   |
| Slate.....                               | 5          | 1800   |
| Big Lime.....                            | 60         | 1860   |
| Big Injun sand (gas pay, 1941').....     | 139        | 1999   |
| Slate.....                               | 63         | 2062   |
| Squaw sand.....                          | 36         | 2098   |
| Slate and shale.....                     | 193        | 2291   |
| Sand.....                                | 9          | 2300   |
| Slate and shale.....                     | 100        | 2400   |
| Sand, (Berea).....                       | 34         | 2434   |
| Slate.....                               | 11         | 2445   |
| Slate and shale.....                     | 38         | 2483   |
| Limy sand.....                           | 68         | 2551   |
| Red rock.....                            | 4          | 2555   |
| Slate and shale.....                     | 285        | 2840   |
| Sand, (Fourth).....                      | 15         | 2855   |
| Slate.....                               | 45         | 2900   |
| Fifth sand and unrecorded to bottom..... | 29         | 2929   |

6 7/8" casing, 1590'.

## J. C. and R. Morris Well Record (224).

Clay district, 2 miles S 15° E of Core. Authority, South Penn Oil Company. Completed Aug. 3, 1911.

| (Elevation, 1205' B-A. T.)   | Thickness.<br>Feet. | Total.<br>Feet. |
|--|---------------------|-----------------|
| Conductor .....  | 14                  | 14              |
| Unrecorded .....   | 486                 | 500             |
| Coal, Mapletown (Sewickley).....   | ..                  | 500             |
| Unrecorded .....   | 90                  | 590             |
| Coal, Pittsburgh .....   | ..                  | 590             |
| Unrecorded .....   | 900                 | 1490            |
| Salt sand (water, 1495').....  | 140                 | 1630            |
| Unrecorded .....   | 55                  | 1685            |
| Maxton sand.....   | 30                  | 1715            |
| Unrecorded .....   | 107                 | 1822            |
| Big Lime.....  | 73                  | 1895            |
| Big Injun sand (gas, 1½ million cu. ft., at 1983'; $\frac{1}{8}$ mer-<br>cury in 5" pipe)..... | 140                 | 2035            |
| Unrecorded .....   | 75                  | 2110            |
| Sand, (Squaw).....   | 40                  | 2150            |
| Unrecorded .....   | 285                 | 2435            |
| Sand, (Gantz) (gas, 4,200,000 cu. ft., at 2498'; 14/10 mer-<br>cury in 5" pipe).....           | 75                  | 2510            |
| Unrecorded .....   | 188                 | 2708            |
| Gordon Stray sand.....   | 1                   | 2709            |
| Gordon sand (gas, 2714').....  | 9                   | 2718            |
| Unrecorded .....   | 152                 | 2870            |
| Fourth sand.....   | 30                  | 2900            |
| Unrecorded .....   | 39                  | 2939            |
| Fifth sand .....   | 7                   | 2946            |
| Unrecorded to bottom (little oil 2948'; little oil, 2986')..                                   | 94                  | 3040            |
| 10" casing, 604'; 8¼" casing, 1508'; 6½" casing, 1839'; 5½" casing,<br>2732'; 4" casing, 197'. |                     |                 |

Shot Aug. 7, 1911, with 20 quarts; Aug. 9, 1911, with 20 quarts.

The gage tests given above for the Big Injun and Gantz sands are equivalent to a production of 4,200,000 and 1,500,000 cubic feet of gas daily, respectively. A fair showing of oil was encountered in the Fifth sand. The **Margaret Davis No. 1 well (225)**, located 0.4 mile southward from the last mentioned well, and drilled during 1911, had a 15 barrel initial oil production from the Fifth sand in addition to a good pay of gas.

According to Hon. E. M. Grant, Morgantown, W. Va., the **Thornton Miller Heirs No. 1 well (228)**, located on the head of Dolls run and drilled in 1890, had an initial gas production of 5,000,000 cu. ft. daily from the Big Injun with a rock pressure of 500 pounds.

The Aaron Hawkins No. 1 well (231), located 1.3 miles northeast of Hagans, had a light gas pay in the Big Injun sand, but was abandoned as a dry hole. It was not drilled below the Big Injun.

Southwestward in the vicinity of Hagans the West Virginia Traction & Electric Company drilled in two Big Injun gassers; viz., Cal Halwkins No. 1 (232) and M. A. Miller No. 2 (233). During 1912 the Hope Natural Gas Company drilled a well in the north edge of Hagans on down through the Fifth sand and obtained a 10-barrel oil well at the latter horizon, the log of which is given next below:

#### D. F. Morris No. 2618 Well Record (234A).

Clay district, at Hagans. Authority, Hon. Jos. H. McDermott. Completed Aug. 17, 1912.

|   | Thickness. | Total. |
|---|------------|--------|
|   | Feet.      | Feet.  |
| Unrecorded .....  | 135        | 135    |
| Coal, native, (Waynesburg).....                             | 4          | 139    |
| Unrecorded .....  | 286        | 425    |
| Coal, Mapletown (Sewickley).....                            | 5          | 430    |
| Unrecorded .....  | 80         | 510    |
| Coal, Pittsburgh (steel line measurement).....              | 5          | 515    |
| Unrecorded .....  | 345        | 860    |
| Sand, (Saltsburg) and unrecorded.....                       | 130        | 990    |
| Sand, Big Dunkard, and unrecorded.....                      | 175        | 1165   |
| Gas sand.....   | 35         | 1200   |
| Unrecorded .....  | 98         | 1298   |
| Sand, (II Cow Run).....                                     | 38         | 1336   |
| Unrecorded .....  | 59         | 1395   |
| Salt sand (water, at 1470').....                            | 138        | 1533   |
| Unrecorded .....  | 67         | 1600   |
| Sand .....  | 20         | 1620   |
| Unrecorded .....  | 110        | 1730   |
| Little Lime.....  | 9          | 1739   |
| Pencil cave.....  | 6          | 1745   |
| Big Lime.....   | 55         | 1800   |
| Big Injun sand (gas, 1898'; 4/10" water in 2" opening)..... | 130        | 1930   |
| Unrecorded .....  | 5          | 1935   |
| Sand, Squaw?.....   | 10         | 1945   |
| Unrecorded .....  | 90         | 2035   |
| Sand, (Squaw) .....   | 40         | 2075   |
| Unrecorded .....  | 170        | 2245   |
| Sand, (Berea).....  | 20         | 2265   |
| Unrecorded .....  | 70         | 2335   |
| Sand, (Gantz).....  | 55         | 2380   |
| Unrecorded .....  | 15         | 2395   |

|  | Thickness.<br>Feet. | Total<br>Feet. |
|--|---------------------|----------------|
| Sand, Fifty-foot.....25' } (Fifty-foot) .....    | 60                  | 2455           |
| Unrecorded .....15 }                             |                     |                |
| Sand .....20 }                                   |                     |                |
| Unrecorded .....                                 | 15                  | 2470           |
| Sand, Thirty-foot.....                           | 60                  | 2530           |
| Unrecorded .....                                 | 81                  | 2611           |
| Sand, Gordon Stray (steel line measurement)..... | 8                   | 2619           |
| Unrecorded .....                                 | 10                  | 2629           |
| Sand, Gordon (steel line)..29' } (Gordon) .....  | 43                  | 2672           |
| Unrecorded .....7 }                              |                     |                |
| Sand .....7 }                                    |                     |                |
| Unrecorded .....                                 | 113                 | 2785           |
| Sand, Fourth.....                                | 13                  | 2798           |
| Unrecorded .....                                 | 43                  | 2841           |
| Sand, Fifth (oil at 2848') (steel line).....     | 49                  | 2890           |
| Unrecorded to bottom.....                        | 22                  | 2912           |

10" casing, 571'; 8¼" casing, 1531'; 6¾" casing, 1795'; and 5½" casing, 2616'.

"Shot to test for oil with 15 quarts nitro-glycerine on Aug. 8, 1912; top of shell, 2848'.

"Cementing record on June 25, 1912:

Size of hole cemented, 16 inch. Amt. of cement used, 5,000 lbs.

Size of casing cemented, 10-inch. Amt. of sand used, 10,000 lbs.

Top of cementing at 395'.

Bottom of cementing at 570'.

The above well had an initial oil production of 10 bbls. daily from the Fifth sand, and the gage test for the Big Injun sand is equivalent to about 100,000 cubic feet daily.

Three practically dry holes were drilled immediately north and northwest of McCurdyville on the H. P. Wilson (236), Jacob A. Eddy (237) and Isaac S. Eddy (238) farms. a light showing of gas being encountered in the latter in the Big Injun. The Hope obtained a gasser at the same horizon on the Newton Varner farm (235), 1 mile northeast of McCurdyville. Passing westward along the southern edge of Clay to the heads of Robinson and Laurel runs there occur some Big Injun gas wells on the John T. Neely (187) and C. W. Yost (186) farms, respectively.

**Prospective Oil and Gas Areas, Clay District.**—This district, like Battelle, has been quite thoroughly tested for oil and gas, yet there remain a few small areas that would justify further drilling. Taking up these areas from west to east, (1) that, along the Big Injun oil belt in the northwestern corner

of the district. lying southwestward from the Jas. Lemley Heirs No. 1 (153) and Asa Lemley No. 3 (154) to the S. D. Lemley No. 2 (156) and the J. N. Wilson No. 1 (157); (2) that, northeastward from the David L. Ammons No. 1 well (192) along the west side of Days run in the Whiteley Basin to near Pentress, appears favorable from a structural standpoint for Bayard sand oil, although the last mentioned well was very light in its oil production from this sand; (3) that, immediately southward along the crest of the Mooresville anticline to near the head of Long Drain, for gas in the sands below the Big Injun; (4) that, northwest of Hagans to the low gap at the head of Little Pawpaw creek, for Big Injun gas; (5) that, south and southwestward from Hagans to the Monongalia-Marion county line for gas in the Big Injun and oil in the Fifth; (6) that, for 1 mile northward and 2 miles north  $20^{\circ}$  to  $45^{\circ}$  eastward from Hagans for oil in the Fifth; and (7) that, for 1 mile northeastward from the J. C. Morris No. 1 (224) and Margaret Morris No. 1 (225) wells for oil or gas in the Fifth sand.

### *Cass District*

Cass district, Monongalia county, lies immediately east of Clay district, west of the Monongahela river and south of Greene county, Penna. Its entire area lies along the western slope of the Indiana anticline. Although its strata are not so warped and twisted as that for Battelle and Clay districts, yet considerable relief prevails, the Pittsburgh coal rising from an elevation of about 420' A. T. near Holman in the extreme northwest point of the district, to almost 1200' A. T., northeastward from VanVoorhis. Along the east and west borders of Cass the rocks dip quite rapidly to the northwest, but in the middle portion there is a slight structural terrace—1 to 2 miles wide—extending from the State line southwestward to Cassville, between the 725 and the 800-foot contours of the Pittsburgh coal as outlined on Map II. The Mt. Morris-Fairview Big Injun sand oil belt extends in a northeast-southwest direction entirely across the northwest corner of Cass. Southeastward up the structural slope from this oil pool there are 60 to 70 gas wells from the same sand within



the boundaries of the district. A large number of these wells are on the structural terrace mentioned above.

No wells have ever been drilled in that portion of Cass northwest of the Big Injun oil pool mentioned above for the reason that heavy doses of salt water are encountered in that sand as the axis of the Lambert syncline is approached from the oil field.

Fifty to sixty producing oil wells have been drilled along the Big Injun sand oil belt above mentioned, which has an average width of about one-half mile. The two following records from wells in this field, although very meagre, give some data of interest:

### W. P. Core No. 9 Well Record (241)

Cass district, 1.4 miles S 10° W of Mt. Morris. Authority, South Penn Oil Company. Completed Nov. 28, 1899.

|   | Thickness.<br>Feet. | Total<br>Feet. |
|---|---------------------|----------------|
| Conductor .....   | 13                  | 13             |
| Unrecorded .....  | 519                 | 532            |
| Pittsburgh coal.....  | ..                  | 532            |
| Unrecorded .....  | 1308                | 1840           |
| Big Injun sand (gas, 1895'; first oil pay, 1916') and unrecorded to bottom.....   | 100                 | 1940           |
| 10" casing, 532'; 8¼" casing, 1431' 10"; 6½" casing, 1418' 9"; 5½" casing, 1846' 3".  |                     |                |
| Shot Jan. 31, 1900, with 10 quarts; Feb. 14, 1901, with 24 quarts; Jan. 2, 1902, with 30 quarts; and Jan. 21, 1905, with 30 quarts. |                     |                |

### C. C. Core No. 2 Well Record (239A).

Clay district, 1.3 miles northeast of Core. Authority, South Penn Oil Company. Completed Oct. 18, 1891.

|   | Thickness.<br>Feet. | Total<br>Feet. |
|---|---------------------|----------------|
| (Elevation, 1355' B-A. T.)  |                     |                |
| Unrecorded .....  | 805                 | 805            |
| Pittsburgh coal.....  | ..                  | 805            |
| Unrecorded .....  | 1283                | 2088           |
| Big Injun sand (first pay, 2175'; second, 2197') and unrecorded to bottom.....                                    | 147                 | 2285           |
| 8¼" casing, 1120'; 6½" casing, 1680'; 5½" casing, 2040'.  |                     |                |
| Shot Mar. 17, 1899, with 5 quarts; July 1, 1899, with 16 quarts; and July 23, 1904, with 24 quarts in second pay. |                     |                |

The Asa Sutton No. 1 well (239), located on the west edge of the oil belt, 1.6 miles northeast of Core, and drilled

about 22 years ago, had an initial oil production of 45 bbls. daily from the Big Injun, but had been abandoned in 1911.

The first well drilled in Cass district, according to Hon. E. M. Grant of Morgantown, was the **Almeda Dorsey No. 1 well (242)**, located 1.5 miles S 10° E of Mt. Morris and completed in the summer of 1888 by the Union Improvement Company. Its initial volume was estimated at 10,000,000 cubic feet, and was the first well connected up to supply Morgantown with gas.

One to two miles east of this Big Injun oil belt there occurs a pool of 20 to 25 gas wells from the same sand along the structural terrace above mentioned. The following records from this field are of special interest for the information they contain concerning the several coals and the depth and volume of the gas pays:

#### Bowen Wade No. 2 Well Record (250).

Dunkard township, Greene county, Pa., 0.9 mile N 20° E of Bowlby. Authority, Randall Gas & Water Company. Completed Sept. 9, 1910.

| (Elevation, 1190' B-A. T.)                              | Thickness. Total. |       |
|---|-------------------|-------|
|   | Feet.             | Feet. |
| Unrecorded .....  | 55                | 55    |
| Coal, Hill (Waynesburg).....                            | 9                 | 64    |
| Unrecorded .....  | 26                | 90    |
| Coal, (Little Waynesburg).....                          | 2                 | 92    |
| Unrecorded .....  | 228               | 320   |
| Mapletown (Sewickley) coal.....                         | 5                 | 325   |
| Unrecorded .....  | 57                | 382   |
| Coal, Redstone.....                                     | 4                 | 386   |
| Unrecorded .....  | 27                | 413   |
| Coal, Pittsburgh.....                                   | 10                | 423   |
| Unrecorded .....  | 763               | 1186  |
| Salt sand (water, 1385').....                           | 245               | 1431  |
| Unrecorded .....  | 204               | 1635  |
| Big Lime.....   | 105               | 1740  |
| Big Injun sand (gas, 1844' and 1865') to bottom.....    | 140               | 1880  |
| 10" casing, 444'; 8¼" casing, 1391'; 6¾" casing, 1452'. |                   |       |
| "Pressure in 6¾" casing.                                |                   |       |
| First minute, 65 lbs. Rock pressure, 105 lbs."          |                   |       |

## Iona Bowlby No. 3 Well Record (251).

Cass district, 0.5 mile northwest of Bowlby. Authority, West Virginia Traction and Electric Company. Completed June 30, 1908.

| (Elevation, 1130' B-A. T.)        | Thickness. Total |       |
|-----------------------------------|------------------|-------|
|                                   | Feet.            | Feet. |
| Conductor .....                   | 15               | 15    |
| Lime .....                        | 4                | 19    |
| Slate .....                       | 2                | 21    |
| Sand .....                        | 14               | 35    |
| Slate shale.....                  | 25               | 60    |
| Lime .....                        | 6                | 66    |
| Slate and shale.....              | 15               | 81    |
| Lime .....                        | 5                | 86    |
| Slate .....                       | 24               | 110   |
| Lime .....                        | 8                | 118   |
| Slate .....                       | 12               | 130   |
| Sand .....                        | 10               | 140   |
| Slate .....                       | 8                | 148   |
| Lime .....                        | 18               | 166   |
| Slate .....                       | 17               | 183   |
| Lime .....                        | 9                | 192   |
| Slate .....                       | 12               | 204   |
| Lime .....                        | 11               | 215   |
| Slate .....                       | 7                | 222   |
| Lime .....                        | 8                | 230   |
| Slate and shale.....              | 17               | 247   |
| Lime .....                        | 19               | 266   |
| Slate .....                       | 10               | 276   |
| Coal, (Sewickley).....            | 6                | 282   |
| Slate .....                       | 24               | 306   |
| Lime .....                        | 7                | 313   |
| Slate shale.....                  | 12               | 325   |
| Lime .....                        | 20               | 345   |
| Slate shale.....                  | 16               | 361   |
| Coal, (Redstone).....             | 5                | 366   |
| Slate .....                       | 10               | 376   |
| Coal, Pittsburgh.....             | 8                | 384   |
| Lime .....                        | 11               | 395   |
| Shale .....                       | 90               | 485   |
| Red rock.....                     | 15               | 500   |
| Slate and shale.....              | 51               | 551   |
| Sand, (Morgantown).....           | 53               | 604   |
| Slate and shale.....              | 66               | 670   |
| Red rock ("Pittsburgh Reds")..... | 26               | 696   |
| Limy sand.....                    | 9                | 705   |
| Slate and shale.....              | 65               | 770   |
| Lime sand.....                    | 11               | 781   |
| Slate .....                       | 15               | 796   |
| Red rock.....                     | 12               | 808   |
| Slate .....                       | 25               | 833   |
| Sandy lime.....                   | 16               | 849   |
| Slate .....                       | 34               | 883   |
| Sand, (Big Dunkard).....          | 38               | 921   |
| Slate .....                       | 31               | 952   |

|                                   | Thickness. | Total. |
|-----------------------------------|------------|--------|
|                                   | Feet.      | Feet.  |
| Sand .....                        | 18         | 970    |
| Slate .....                       | 8          | 978    |
| Sand .....                        | 17         | 995    |
| Slate .....                       | 25         | 1020   |
| Sand .....                        | 21         | 1041   |
| Coal, (Lower Freeport).....       | 4          | 1045   |
| Slate and shale.....              | 20         | 1065   |
| White sand, (Lower Freeport)..... | 55         | 1120   |
| Black slate.....                  | 10         | 1130   |
| Limy sand.....                    | 18         | 1148   |
| Slate and shale.....              | 29         | 1177   |
| Limy sand.....                    | 22         | 1199   |
| Slate .....                       | 28         | 1227   |
| Sand (II Cow Run).....            | 65         | 1292   |
| Black slate.....                  | 14         | 1306   |
| Sand .....                        | 16         | 1322   |
| Slate and shale.....              | 45         | 1367   |
| Sand, (Salt).....                 | 85         | 1452   |
| Slate and shale.....              | 20         | 1472   |
| Red rock.....                     | 40         | 1512   |
| Sandy lime.....                   | 15         | 1527   |
| Red rock.....                     | 20         | 1547   |
| Lime .....                        | 10         | 1557   |
| Slate .....                       | 7          | 1564   |
| Lime .....                        | 15         | 1579   |
| Slate break.....                  | 5          | 1584   |
| Big Lime.....                     | 70         | 1654   |
| Unrecorded .....                  | 1          | 1655   |

Big Injun sand (gas).

"Pressure, first minute, 25 lbs. in 5  $\frac{1}{8}$ " pipe."

The Sanford Wade No. 1 well (253), located 1.1 miles N 80° W of Bowlby and completed in 1890, was the heaviest gasser, according to E. M. Grant, drilled in this field, having an initial rock pressure of 550 pounds and a volume estimated at 15 to 20 million cu. ft. of gas daily. The well blew into the air for the first 6 months, and owing to the weakness of the casing used, could not be shut in entirely until two years after completion. It was the second gas well drilled in Cass district and was connected up with the Union Improvement Company's line to Morgantown.

### Spencer Cunningham No. 1 Well Record (254)

Cass district, 1.2 miles west of Bowlby. Authority, West Virginia Traction & Electric Company. Completed Jan. 12, 1907.

| (Elevation, 1195' B-A. T.)  | Thickness. Total. |       |
|---|-------------------|-------|
|   | Feet.             | Feet. |
| Unrecorded .....  | 145               | 145   |
| Mt. Morris (Waynesburg) coal.....   | 5                 | 150   |
| Unrecorded .....  | 285               | 435   |
| Mapletown (Sewickley) coal.....   | 5                 | 440   |
| Unrecorded .....  | 80                | 520   |
| Pittsburgh coal.....  | 10                | 530   |
| Unrecorded .....  | 1296              | 1826  |
| Big Injun sand (small gas, 1829'; gas, 1903' and 1918') and unrecorded to bottom.....               | 137               | 1963  |
| 8" casing, 134'; 5 $\frac{1}{8}$ " casing, 1826'; 3" tubing, 1827'.                                 |                   |       |
| "Rock pressure, 160 lbs.; mercury test, 1.06 inches in 4" tubing; Volume, 2,200,000 cu. ft. daily." |                   |       |

### Iona Bowlby No. 4 Well Record (255).

Cass district, 0.6 mile S., 80° W. of Bowlby. Authority, West Virginia Traction & Electric Company. Completed Sept. 26, 1908.

| (Elevation, 1220' B-A. T.)                      | Thickness. Total. |       |
|---|-------------------|-------|
|   | Feet.             | Feet. |
| Conductor .....                                 | 14                | 14    |
| Slate .....                                     | 22                | 36    |
| Sand .....                                      | 63                | 99    |
| Mt. Morris (Waynesburg) coal .....              | 6                 | 105   |
| Slate, shale and lime in alternate layers ..... | 267               | 372   |
| Coal, (Sewickley) .....                         | 6                 | 378   |
| Slate .....                                     | 21                | 399   |
| Sand ..   | 16                | 415   |
| Shale .....                                     | 22                | 437   |
| Lime .....                                      | 20                | 457   |
| Slate .....                                     | 5                 | 462   |
| Slate and coal (Pittsburgh).....                | 10                | 472   |
| Lime shales and sand in layers (no coal) .....  | 472               | 1022  |
| Sand, Big Dunkard .....                         | 90                | 1112  |
| Sandy shales .....                              | 33                | 1145  |
| "Gas" sand (gas) .....                          | 85                | 1230  |
| Slate shales .....                              | 20                | 1250  |
| Unrecorded to bottom .....                      | 151               | 1401  |
| 10" casing, 480'; 8" casing, 1040'.             |                   |       |

The above well is a gasser in the "Gas" sand and was not drilled to the Big Injun.

**Geo. Weaver No. 1 Well Record (258).**

Cass district, 1.8 miles S., 80° W. of Bowlby. Authority, West Virginia Traction & Electric Company. Completed January, 1900.

| (Elevation, 1180' B.-A. T.)                               | Thickness. | Total. |
|---|------------|--------|
|   | Feet.      | Feet.  |
| Unrecorded .....  | 444        | 444    |
| Pittsburgh coal .....                                     | ..         | 444    |
| Unrecorded .....  | 1310       | 1754   |
| Big Injun sand (first pay, 1806'; second, 1844').....     |            |        |
| "Open flow, mercury test, 1.00 in 3" pipe, May 16, 1907." |            |        |

The above gage test is equivalent, 1,240,000 cu. ft. of gas daily. According to E. M. Grant, its initial volume was 3 to 4 million cu. ft. daily, and rock pressure, 300 pounds.

**Wm. McCormick No. 2 Well Record (259).**

Cass district, 1.5 miles southwest of Bowlby. Authority, West Virginia Traction & Electric Company. Completed Mar. 12, 1909.

| (Elevation, 1245' B.-A. T.)   | Thickness. | Total. |
|---|------------|--------|
|   | Feet.      | Feet.  |
| Conductor .....   | 15         | 15     |
| Slate .....   | 9          | 24     |
| Bluff sand .....  | 71         | 95     |
| Slate .....   | 5          | 100    |
| Mt. Morris (Waynesburg) coal .....  | 8          | 108    |
| Slate and unrecorded .....  | 267        | 375    |
| Mapletown (Sewickley) coal .....  | 5          | 380    |
| Slate and shale .....   | 30         | 410    |
| Lime .....  | 11         | 421    |
| Slate and shale .....   | 19         | 440    |
| Lime .....  | 18         | 458    |
| Black slate .....   | 8          | 466    |
| Pittsburgh coal .....   | 8          | 474    |
| Slate, shale and sand, with no coal .....   | 1125       | 1599   |
| Lime .....  | 18         | 1617   |
| Slate .....   | 7          | 1624   |
| Big Lime .....  | 68         | 1692   |
| Big Injun sand (first pay, 1883') and unrecorded<br>to bottom .....               | 240        | 1932   |
| "Driller's record shows difference of 92'."                                       |            |        |
| 10" casing, 500'; 8" casing, 1247'; 6½" casing, 1532'.. 5 3/16"<br>casing, 1802'. |            |        |

The detailed record between the Sewickley and Pittsburgh coals is given to show the absence of Redstone coal immediately to the west of a region where it frequently attains minable thickness.

### Frank McCormick No. 1 Well Record (260).

Cass district, 1.4 miles southwest of Bowlby. Authority, West Virginia Traction & Electric Company.

| (Elevation, 1215' B.-A. T.)                             | Thickness. |             |
|---|------------|-------------|
|   | Feet.      | Total Feet. |
| Conductor .....   | 7          | 7           |
| Bluff sand .....  | 58         | 65          |
| Mt. Morris (Waynesburg) coal .....                      | 5          | 70          |
| Slate, shale and sand in layers. ....                   | 280        | 350         |
| Mapletown (Sewickley) coal .....                        | 6          | 356         |
| Slate .....   | 16         | 372         |
| Lime .....  | 15         | 387         |
| Slate .....   | 11         | 398         |
| Lime .....  | 17         | 415         |
| Slate .....   | 8          | 423         |
| Pittsburgh coal .....                                   | 8          | 431         |
| Slate, red rock, lime and sand in layers, no coal ..... | 1208       | 1639        |
| Lime .....  | 18         | 1657        |
| Black slate .....                                       | 7          | 1664        |
| Big Lime .....  | 84         | 1748        |
| Big Injun sand (first pay, 1848'; second, 1863') .....  | 134        | 1882        |

The following is the record of a gasser in both the Big Injun and Berea sands. It was drilled on down through the Bayard.

### Mark Weaver No. 1 Well Record (262).

Cass district, 1.9 miles southwest of Bowlby. Authority, West Virginia Traction & Electric Company. Completed July 2, 1909.

| (Elevation, 1130' B.-A. T.)  | Thickness. |             |
|--|------------|-------------|
|  | Feet.      | Total Feet. |
| Conductor .....  | 14         | 14          |
| Slate .....  | 16         | 30          |
| Sand, (Waynesburg.) .....  | 60         | 90          |
| Slate .....  | 10         | 100         |
| Mt. Morris (Waynesburg) coal .....   | 8          | 108         |
| Slate, shale and lime, no coal .....   | 277        | 385         |
| Mapletown (Sewickley) coal .....   | 5          | 390         |
| Slate and shale .....  | 28         | 418         |
| Lime .....   | 13         | 431         |
| Slate .....  | 17         | 448         |
| Lime .....   | 17         | 465         |
| Slate .....  | 12         | 477         |
| Pittsburgh coal .....  | 8          | 485         |
| Slate, shale, red rock, with alternate layers of sand and shale .....        | 1215       | 1700        |
| Lime .....   | 14         | 1714        |
| Slate .....  | 11         | 1725        |
| Big Lime .....   | 61         | 1786        |
| Big Injun sand (red break, 1796'; first gas pay, 1875'; second, 1890') ..... | 165        | 1951        |

|  | Thickness. | Total. |
|--|------------|--------|
|  | Feet.      | Feet.  |
| Slate and shale .....  | 34         | 1985   |
| Sand shales (Squaw) .....  | 44         | 2029   |
| Slate and shale mixed .....  | 303        | 2332   |
| Sand, (Berea) (gas pay, 2350'.)  | 53         | 2385   |
| Black slate .....  | 12         | 2397   |
| Sand .....   | 37         | 2434   |
| Red shale .....  | 44         | 2478   |
| Slate and shale .....  | 39         | 2517   |
| Red rock .....   | 30         | 2547   |
| Slate .....  | 17         | 2564   |
| Lime shales .....  | 26         | 2590   |
| Red lime shales .....  | 30         | 2620   |
| Limy sand (Gordon Stray) .....   | 35         | 2655   |
| Slate and shale .....  | 40         | 2695   |
| Limy sand (Gordon) .....   | 28         | 2723   |
| Slate .....  | 36         | 2759   |
| Sand, (Fourth) .....   | 23         | 2782   |
| Slate .....  | 34         | 2816   |
| Sand, (Fifth) .....  | 36         | 2852   |
| Slate and shale .....  | 43         | 2895   |
| Sand, (Bayard) .....   | 68         | 2963   |
| Slate and shale to bottom .....  | 30         | 2993   |
| 10" casing, 507'; 8" casing, 1153'; 6½" casing, 1510'; 5" casing, 1786'. |            |        |

The driller evidently made no attempt to correlate the sands below the Big Injun, but the names in parentheses, inserted by the writer, approximate closely the formation indicated.

### Justus Brewer No. 1 Well Record (263).

Cass district, 2.2 miles northeast of Cassville. Authority, West Virginia Traction & Electric Company. Completed Mar. 15, 1908.

|  | Thickness. | Total. |
|--|------------|--------|
|  | Feet.      | Feet.  |
| (Elevation, 1000' B.-A. T.)                            |            |        |
| Slate, lime and shells .....                           | 130        | 130    |
| Mapletown (Sewickley) coal .....                       | 6          | 136    |
| Slate and shale .....                                  | 20         | 156    |
| Lime .....   | 13         | 169    |
| Slate .....  | 17         | 186    |
| Lime .....   | 23         | 209    |
| Black slate .....                                      | 11         | 220    |
| Pittsburgh coal .....                                  | 10         | 230    |
| Slate, shale, red rock and sand, with no coal .....    | 1210       | 1440   |
| Lime .....   | 12         | 1452   |
| Slate .....  | 8          | 1460   |
| Big Lime .....   | 60         | 1520   |
| Sandy Lime .....                                       | 22         | 1542   |
| Big Injun sand (first pay, 1648'; second, 1666') ..... | 145        | 1687   |
| Slate and shale .....                                  | 148        | 1835   |
| Sand, (Squaw) .....                                    | 40         | 1875   |



|   | Thickness. | Total. |
|---|------------|--------|
|   | Feet.      | Feet.  |
| Slate and shale .....   | 258        | 2133   |
| Sand, (Gantz) .....   | 25         | 2158   |
| Slate .....   | 14         | 2172   |
| Sand slate (Fifty-foot) .....   | 100        | 2272   |
| Red rock .....  | 28         | 2300   |
| Limy sand .....   | 8          | 2308   |
| Slate and shale .....   | 14         | 2322   |
| Limy sand .....   | 8          | 2330   |
| Shale and red rock .....  | 90         | 2420   |
| Sand shales (Stray) .....   | 35         | 2455   |
| Slate .....   | 30         | 2485   |
| Sand shales, (Gordon) .....   | 26         | 2511   |
| Slate and shale .....   | 40         | 2551   |
| Sand shales (Fourth) .....  | 20         | 2571   |
| Slate .....   | 14         | 2585   |
| Sand (Fifth) .....  | 22         | 2607   |
| Slate .....   | 26         | 2633   |
| Sand, (Bayard) (oil show, 2690') .....                                  | 76         | 2709   |
| Slate to bottom .....   | 11         | 2720   |
| 10" casing, 371'; 8" casing, 1213'; 6" casing, 1295'; 5" casing, 1544'. |            |        |

Southwestward along the structural terrace heretofore mentioned there are several gas wells in the southern edge of Cass district both east and west of Cassville. The two following records are from wells in this field in which both the Big Injun and Fifth sands appear productive:

#### Wm. Higgins No. 1 Well Record (266).

Cass district, 0.8 mile east of Cassville. Authority, West Virginia Traction & Electric Company. Completed July 5, 1910.

|  | Thickness. | Total. |
|--|------------|--------|
| (Elevation, 955' B.-A. T.)   | Feet.      | Feet.  |
| Slate and lime .....   | 82         | 82     |
| Mapletown (Sewickley) coal .....   | 5          | 87     |
| Slate and shale .....  | 12         | 99     |
| Lime .....   | 9          | 108    |
| Slate and shale .....  | 20         | 128    |
| Lime .....   | 11         | 139    |
| Slate .....  | 18         | 157    |
| Lime .....   | 12         | 169    |
| Slate .....  | 9          | 178    |
| Pittsburgh coal .....  | 8          | 186    |
| Slate, shale, lime and sand in alternate layers,<br>no coal .....                    | 1258       | 1444   |
| Big Lime .....   | 60         | 1504   |
| Big Injun sand (first pay, 1613'; second, 1631') and unre-<br>corded to bottom ..... | 132        | 1636   |
| 10" casing, 230'; 8" casing, 1045'; 6" casing, 1504'.                                |            |        |

**Chas. E. Core No. 1 Well Record (270).**

Cass district, 1.2 miles southwest of Cassville. Authority, West Virginia Traction & Electric Company. Completed September, 1902.

|   | Thickness. Total. |       |
|---|-------------------|-------|
| (Elevation, 1165' B.-A. T.)   | Feet.             | Feet. |
| Unrecorded .....  | 470               | 470   |
| Pittsburgh coal .....   | ..                | 470   |
| Unrecorded .....  | 1280              | 1750  |
| Big Injun sand (gas pay, 1837', 1846' and 1861') and unrecorded to bottom ..... | 141               | 1891  |
| 5 3/16" casing, 1770'; 3" tubing, 1500'.  |                   |       |
| "3.04 inches mercury on open flow in 2" pipe, May 15, 1907.                     |                   |       |
| Volume, 991,000 cu. ft. of gas daily."  |                   |       |

The detailed log of **David Henderson No. 1 well (269)** is published in connection with the Cassville section, page 100. It is a gasser from both the Big Injun and Fifth sands.

The **Amasa Cole No. 1 well (268A)**, located 0.6 mile west of Cassville and completed by E. M. Hukill & Company in 1889, was the first gas well drilled this far south in Cass district, according to E. M. Grant. It had an initial volume of 5,000,000 cu. ft. daily and a rock pressure of 500 pounds.

The **Jas. Kennedy No. 1 well (264A)**, located 1.6 miles east of Cassville, made several barrels of oil from the Bayard sand—2450 feet below the Pittsburgh coal—showing for 2 to 3 barrels daily, but it was abandoned as non-paying in a few days after completion. A light gas pay was encountered in the Big Injun.

In the northeastern portion of Cass district there are 35 to 40 gas wells on the waters of Robinson run in the vicinity of Madsville, in which the Big Injun is the main producing sand. The 10 following records from wells in this field, none of which was drilled below the Big Injun to the deep sands, show the presence of apparently minable coal in the Allegheny series in addition to four minable beds in the Monongahela measures, as well as interesting gas pressure tests. The Pittsburgh coal—Big Injun sand interval averages about 1325 feet.

## John Laird (E. Roach) No. 1 Well Record (272).

Cass district, 1.4 miles S., 80° W. of Madsville. Authority, West Virginia Traction & Electric Company. Completed Sept. 21, 1911.

|   | Thickness. Total. |       |
|---|-------------------|-------|
|   | Feet.             | Feet. |
| (Elevation, 1135' B.-A. T.)   |                   |       |
| Conductor .....   | 9                 | 9     |
| Unrecorded .....  | 178               | 187   |
| Mapletown (Sewickley) coal .....  | 5                 | 192   |
| Unrecorded .....  | 58                | 250   |
| Redstone coal .....   | 2                 | 252   |
| Unrecorded .....  | 24                | 276   |
| Pittsburgh coal .....   | 10                | 286   |
| Unrecorded .....  | 483               | 769   |
| Little Dunkard sand .....   | 47                | 816   |
| Unrecorded .....  | 41                | 857   |
| Big Dunkard sand .....  | 57                | 914   |
| Unrecorded .....  | 57                | 971   |
| Coal, Freeport? (Upper Kittanning) .....                                | 5                 | 976   |
| Unrecorded .....  | 27                | 1003  |
| Gas sand .....  | 18                | 1021  |
| Coal, (Lower Kittanning) .....  | 6                 | 1027  |
| Unrecorded .....  | 80                | 1107  |
| Sand, (II Cow Run) .....  | 20                | 1127  |
| Coal, (gas) (Tionesta) .....  | 3                 | 1130  |
| Slate .....   | 7                 | 1137  |
| Second Salt sand (water) .....  | 151               | 1288  |
| Unrecorded .....  | 133               | 1421  |
| Little Lime .....   | 35                | 1456  |
| Pencil cave .....   | 28                | 1484  |
| Unrecorded .....  | 36                | 1520  |
| Big Lime .....  | 76                | 1596  |
| Big Injun sand (break, 1614'-1616'; gas, 1685'; sand broken) .....      | 157               | 1753  |
| Unrecorded to bottom.....   | 26..              | 1779  |
| 10" casing, 355'; 8" casing, 1195'; 6" casing, 1340'; 5" casing, 1614'. |                   |       |

## Elza Davis No. 1 Well Record (273).

Cass district, 1.1 miles west of Madsville. Authority, West Virginia Traction & Electric Company. Completed June 20, 1911.

|  | Thickness. Total. |       |
|--|-------------------|-------|
|  | Feet.             | Feet. |
| (Elevation, 1050' B.-A. T.)                            |                   |       |
| Conductor .....  | 19                | 19    |
| Slate .....  | 52                | 71    |
| Mapletown (Sewickley) coal.....                        | 5                 | 76    |
| Lime .....   | 59                | 135   |
| Slate .....  | 12                | 147   |
| Redstone coal .....                                    | 5                 | 152   |
| Lime .....   | 18                | 170   |
| Slate .....  | 8                 | 178   |
| Pittsburgh coal.....                                   | 11                | 189   |
| Slate, lime shales, sand in layers, without coal ..... | 691               | 880   |
| Coal, (Upper Kittanning) .....                         | 5                 | 885   |

|   | Thickness.<br>Feet. | Total.<br>Feet. |
|---|---------------------|-----------------|
| Lime .....  | 25                  | 910             |
| Slate and shales .....  | 28                  | 938             |
| Gas sand (gas and water) .....  | 23                  | 961             |
| Slate, sand, shell, reds and lime, no coal.....   | 455                 | 1416            |
| Big Lime .....  | 82                  | 1498            |
| Big Injun sand (first gas pay, 1509'; second, 1583'; third,<br>1593'; fourth, 1600') and unrecorded to bottom ..... | 137                 | 1635            |
| 5 3/16" casing, 1498'.  |                     |                 |

**Wm. H. Smith No. 1 Well Record (274).**

Cass district, 1.1 miles west of Cassville. Authority, West Virginia Traction & Electric Company. Completed April 22, 1911.

| (Elevation, 1155' B.-A. T.)   | Thickness.<br>Feet. | Total.<br>Feet. |
|---|---------------------|-----------------|
| Conductor .....   | 16                  | 16              |
| Unrecorded .....  | 174                 | 190             |
| Mapletown (Sewickley) coal .....  | 5                   | 195             |
| Unrecorded .....  | 101                 | 296             |
| Pittsburgh coal .....   | 11                  | 307             |
| Unrecorded .....  | 659                 | 966             |
| Coal, Upper Freeport? (Lower Freeport) .....  | 6                   | 972             |
| Unrecorded .....  | 26                  | 998             |
| Coal, Lower Freeport? (Upper Kittanning) (water) .....  | 5                   | 1003            |
| Unrecorded .....  | 114                 | 1117            |
| Salt sand, broken (water, 1223') and unrecorded .....   | 412                 | 1529            |
| Big Lime .....  | 75                  | 1604            |
| Big Injun sand (first pay, 1627"; break at 1646'; second<br>pay, 1711'; third pay, 1717') ..... | 75                  | 1679            |
| Unrecorded to bottom .....  | 69                  | 1748            |
| 10" casing, 380'; 8" casing, 1443'; 5" casing, 1605'.   |                     |                 |

**E. H. Clevenger No. 1 Well Record (275).**

Cass district, 1.2 miles N., 80° W. of Madsville. Authority, Randall Gas & Water Company. Completed July 16, 1911.

| (Elevation, 1170' B.-A. T.)  | Thickness.<br>Feet. | Total.<br>Feet. |
|--|---------------------|-----------------|
| Unrecorded .....   | 107                 | 107             |
| Coal, Mapletown .....  | 5                   | 112             |
| Unrecorded .....   | 198                 | 310             |
| Coal, Pittsburgh .....   | 10                  | 320             |
| Unrecorded (water, 543') .....   | 522                 | 842             |
| Sand, Big Dunkard and Burning Springs .....  | 203                 | 1045            |
| Coal, (Upper Kittanning) .....   | 5                   | 1050            |
| Unrecorded .....   | 117                 | 1167            |
| Salt sand .....  | 208                 | 1375            |
| Unrecorded .....   | 210                 | 1585            |
| Big Lime .....   | 51½                 | 1636½           |
| Big Injun sand (gas, 1643'-1649'; slate, 1661'-1670'; gas,<br>1756½'-1763'; gas, 1767½'-1777') to bottom ..... | 141½                | 1777            |
| 10" casing, 393'3"; 8½" casing, 1167'; 6 5/8" casing, 1397'.   |                     |                 |
| "Pressure in 6 5/8" casing:<br>1st minute, 45 lbs.; Rock pressure, 245 lbs."                                   |                     |                 |

**James Saunders No. 1 Well Record (277).**

Cass district, at Maidsville. Authority, West Virginia Traction & Electric Company.

|  | Thickness. Total. |       |
|--|-------------------|-------|
|  | Feet.             | Feet. |
| Slate, lime, sand, red rock in layers, no coal .....                   | 488               | 488   |
| Coal, (Upper Freeport).....  | 6                 | 494   |
| Slate and shale .....  | 20                | 514   |
| Sand, ("Gas") .....  | 87                | 601   |
| Coal, (Upper Kittanning) .....   | 6                 | 607   |
| Slate, lime, sand, red rock in alternate layers, no coal ..            | 548               | 1155  |
| Big Lime .....   | 60                | 1215  |
| Big Injun sand (first pay, 1348') and unrecorded<br>to bottom .....    | 148               | 1363  |
| 10" casing, 148'; 8" casing, 613'; 6½" casing, 946'; 5" casing, 1217'. |                   |       |

The Pittsburgh coal—Big Injun sand interval in this region is about 1325 feet; hence, the above record starts about 110 feet below the Pittsburgh coal.

**Jasper Stone No. 1 Well Record (279).**

Cass district, 1 mile northwest of Maidsville. Authority, Randall Gas & Water Company.

|  | Thickness. Total. |       |
|--|-------------------|-------|
|  | Feet.             | Feet. |
| (Elevation, 895' B.-A. T.)   |                   |       |
| Unrecorded (water, 40') .....  | 219               | 219   |
| Little Dunkard sand and unrecorded.....                                      | 302               | 521   |
| Big Dunkard sand and unrecorded .....  | 184               | 705   |
| Coal, Freeport? (Upper Kittanning) and unrecorded<br>(water, 1061') .....    | 545               | 1250  |
| Big Lime .....   | 75                | 1325  |
| Big Injun sand (gas at 1335', 1420', 1436' and 1450')<br>to bottom .....     | 162½              | 1487½ |
| 10" casing, 242'; 8¼" casing, 668'; 6 5/8" casing, 1079'.                    |                   |       |
| "Pressure test in 2" tubing:<br>1st minute, 95 lbs. Rock pressure, 250 lbs." |                   |       |

The above well starts nearly flush with the crop of the Pittsburgh coal; hence, the seam at 705' represents the Upper Kittanning.

**M. G. Murphy No. 2 Well Record (280).**

Cass district, 1.2 miles northwest of Maidsville. Authority, Mississippi Glass Company. Completed in May, 1911.

|                            | Thickness. Total. |       |
|----------------------------|-------------------|-------|
|                            | Feet.             | Feet. |
| (Elevation, 910' B.-A. T.) |                   |       |
| Unrecorded .....           | 12                | 12    |
| Pittsburgh coal .....      | 10                | 22    |

|  | Thickness. | Total. |
|--|------------|--------|
|  | Feet.      | Feet.  |
| Unrecorded .....   | 425        | 447    |
| Little Dunkard sand .....  | 15         | 462    |
| Unrecorded .....   | 68         | 530    |
| Sand, (Big Dunkard, Burning Springs and "Gas") .....   | 197        | 727    |
| Coal, Freeport? (Upper Kittanning.) .....  | 4          | 731    |
| Unrecorded .....   | 95         | 826    |
| Sand .....   | 20         | 846    |
| Coal, (Clarion) .....  | 6          | 852    |
| Unrecorded .....   | 13         | 865    |
| Lime (II Cow Run and Salt) .....   | 212        | 1077   |
| Unrecorded .....   | 162        | 1239   |
| Little Lime .....  | 15         | 1254   |
| Unrecorded .....   | 81         | 1335   |
| Big Injun sand (little gas, 1339'-1341'; slate, 1350'-1354';<br>little gas, 1365'-1370'; fair pay of gas, 1459'-1479') ..... | 155        | 1490   |
| Unrecorded to bottom .....   | 0½         | 1490½  |

## Peter Lazzell No. 1 Well Record (281).

Cass district, 1.3 miles northwest of Maidsville. Authority, Mississippi Glass Company. Completed in March, 1911.

| (Elevation, 1170' B.-A. T.)   | Thickness. | Total. |
|---|------------|--------|
|   | Feet.      | Feet.  |
| Unrecorded .....  | 134        | 134    |
| Mapletown (Sewickley) coal .....  | 7          | 141    |
| Unrecorded .....  | 66         | 207    |
| Redstone coal .....   | 4          | 211    |
| Unrecorded .....  | 13         | 229    |
| Pittsburgh coal .....   | 13         | 242    |
| Unrecorded .....  | 653        | 895    |
| Coal, (Lower Freeport) .....  | 7          | 902    |
| Gas sand .....  | 31         | 933    |
| Coal, (Upper Kittanning) .....  | 6          | 939    |
| Unrecorded .....  | 96         | 1035   |
| Sand .....  | 30         | 1065   |
| Unrecorded .....  | 4          | 1069   |
| Coal, (Clarion) .....   | 10         | 1079   |
| Sand, (II Cow Run and Salt) .....   | 225        | 1304   |
| Unrecorded .....  | 186        | 1490   |
| Big Lime .....  | 76         | 1566   |
| Big Injun sand (gas pay, 1591'-1595'; slate, 1646'-1666';<br>second pay, 1666'-1681') and unrecorded to bottom .. | 130        | 1696   |

## T. A. and J. F. Keenan No. 1 Well Record (283).

Cass district, 1.2 miles N., 5° W. of Maidsville. Authority, West Virginia Traction & Electric Company. Completed Nov. 7, 1911.

| (Elevation, 1035' B.-A. T.)      | Thickness. | Total. |
|----------------------------------|------------|--------|
|                                  | Feet.      | Feet.  |
| Conductor .....                  | 14         | 14     |
| Slate .....                      | 4          | 18     |
| Mapletown (Sewickley) coal ..... | 5          | 23     |

|  | Thickness.<br>Feet. | Total.<br>Feet. |
|--|---------------------|-----------------|
| Lime .....   | 34                  | 57              |
| Slate .....  | 29                  | 86              |
| Redstone coal .....  | 4                   | 90              |
| Lime .....   | 27                  | 117             |
| Pittsburgh coal.....   | 7                   | 124             |
| Slate, lime and sand in layers, no coal .....  | 562                 | 686             |
| Sand, Big Dunkard, and Burning Springs and "Gas".....  | 151                 | 837             |
| Freeport coal (Upper Kittanning) .....   | 3                   | 840             |
| Slate and shells .....   | 116                 | 956             |
| Coal, (Clarion) .....  | 4                   | 960             |
| Sand, (H Cow Run and salt).....  | 178                 | 1138            |
| Sandy lime .....   | 69                  | 1207            |
| Red rock .....   | 15                  | 1222            |
| Gritty lime .....  | 46                  | 1268            |
| Red rock .....   | 86                  | 1354            |
| Little Lime .....  | 15                  | 1369            |
| Pencil cave .....  | 5                   | 1374            |
| Big Lime .....   | 78                  | 1452            |
| Big Injun sand (break, 1531'-1537'; first pay, 1542'-1545')<br>and unrecorded to bottom .....                      | 140                 | 1592            |
| 10" casing, 197'; 8" casing, 845'; 6 5/8" casing, 1151'; 5 3/16"<br>casing, 1495'; 2" tubing; packer set at 1517'. |                     |                 |

### Marion J. Garlow No. 1 Well Record (287).

Cass district, 1.8 miles north of Madsville. Authority, Carnegie Natural Gas Company. Completed Dec: 4, 1906.

|  | Thickness.<br>Feet. | Total.<br>Feet. |
|--|---------------------|-----------------|
| Unrecorded .....   | 88                  | 88              |
| Pittsburgh coal .....  | 6                   | 94              |
| Unrecorded .....   | 1360                | 1454            |
| Big Injun sand (gas, 1548' and 1562') and unrecorded<br>to bottom .....                | 150                 | 1604            |
| 10" casing, 230'; 8 1/2" casing, 1134'; 6 5/8" casing, none; 5 3/16"<br>casing, 1538'. |                     |                 |

" First pressure test in 5 3/16" casing:

|                      |                         |
|----------------------|-------------------------|
| 1st minute, 55 lbs.  | 4th minute, 155 lbs.    |
| 2nd minute, 100 lbs. | 5th minute, 170 lbs.    |
| 3rd minute, 130 lbs. | Rock pressure, 350 lbs. |

An examination of the foregoing well records from the gas fields of Cass shows that the rock pressure in the Big Injun has fallen off greatly from that in the first wells drilled in the district, in which it was recorded at 550 pounds. This holds true in every gas field soon after the pool has been tapped by several wells. An interesting account of **Rock Pressure in Oil and Gas Wells** along with a discussion of the

causes and the maximum reported in the State is given on pages 65-73 of Vol. I (A) of the State Survey reports.

**Prospective Oil and Gas Areas, Cass District.**—Portions of Cass have been quite thoroughly tested by the drill for Big Injun gas and oil, but there yet remains quite a large area of the district favored by structure and untested in the deeper sands, and in addition a few small areas that would justify further drilling to the Big Injun. Discussing these areas roughly from west to east, (1) that portion of the district lying between the 725 and 775-foot contours of the Pittsburgh coal as outlined on Map II, northward from the Grant-Cass district line to near the head of Augustin run, appears favorable for Big Injun gas; (2) that, northward from the same district line between the 750 and 825-foot contours of the Pittsburgh coal to an east and west line through the Justice Brewer No. 1 well (263), for oil in the Bayard sand and light gas in the Big Injun; (3) that, northward from the same district line between the 825 and 925-foot contours of the Pittsburgh coal would warrant further tests for Big Injun gas; and (4) the same is true of that portion of the district southward from the State line to VanVoorhis between the Monongahela river and the 1150-foot contour of the Pittsburgh coal.

### ***Grant District.***

Grant district, Monongalia county, lies immediately south and east of Cass and Clay districts, west of the Monongahela river, and northeast of Marion County. With the exception of slightly over a square mile northeast of Uffington, its entire area lies along the western flank of the Indiana anticline; hence, practically the same structural conditions prevail as in Cass district. Within its borders the Pittsburgh coal horizon ranges in elevation from 625' A.T. on the extreme head of Little Indian Creek, to almost 1500' A.T. opposite Little Falls. No paying oil pools have yet been opened in the district, but a very prolific gas pool has been developed along its western edge on the head of Little Indian creek, consisting of 15 to 20 wells in which the Big Injun and Fifth sands are the main



producing horizons. The following records from wells in this field give interesting data as to the volume and pressure of the gas, the relative position of the sands and the thickness of the minable coals of the Monongahela series. The intervals from the Pittsburgh coal to the deep sands vary but little from that given for the western portion of Monongalia county, and the same is true for the Big Injun, the latter ranging from 1300 to 1325 feet.

### Martha A. Miller No. 2 Well Record (298).

Grant district, 2.1 miles northeast of Hagans. Authority, West Virginia Traction & Electric Company. Completed in 1911.

| (Elevation, 1255' B.-A. T.)   | Thickness.<br>Feet. | Total<br>Feet. |
|---|---------------------|----------------|
| Conductor .....   | 14                  | 14             |
| Unrecorded .....  | 226                 | 240            |
| Mt. Morris (Waynesburg) coal .....  | ..                  | 240            |
| Unrecorded .....  | 278                 | 518            |
| Mapletown (Sewickley) coal .....  | ..                  | 518            |
| Unrecorded .....  | 82                  | 600            |
| Pittsburgh coal .....   | ..                  | 600            |
| Unrecorded .....  | 1242                | 1842           |
| Big Lime .....  | 57                  | 1899           |
| Big Injun sand (light gas pay, 2008') .....   | 141                 | 2040           |
| Unrecorded .....  | 17                  | 2057           |
| Squaw sand .....  | 53                  | 2110           |
| Unrecorded .....  | 321                 | 2431           |
| Sand, (Berea) .....   | 35                  | 2466           |
| Unrecorded .....  | 241                 | 2707           |
| Stray sand (gas show in top) .....  | 15                  | 2722           |
| Unrecorded .....  | 78                  | 2800           |
| Gordon sand (shales) and unrecorded .....   | 96                  | 2896           |
| Fourth sand .....   | 22                  | 2918           |
| Unrecorded .....  | 27                  | 2945           |
| Fifth sand, (first pay, small, 2955'; second pay,<br>large, 2960') and unrecorded to bottom ..... | 35                  | 2980           |
| "2" connections for Big Injun gas; and 4" connections for Fifth<br>sand gas."                     |                     |                |

The initial gas production in the Fifth sand in the above well was 7 to 8 million cu. ft. daily, with 700 pounds rock pressure, and in September, 1911, it was furnishing practically all the gas required by consumers in Morgantown, the other wells owned by same company being shut in temporarily.

**J. N. Michael No. 1 Well Record (299).**

Grant district, 2 miles northeast of Hagans. Authority, Carnegie Natural Gas Company. Completed Feb. 27, 1911.

| (Elevation, 1215' B.-A. T.)   | Thickness.            | Total. |
|---|-----------------------|--------|
|   | Feet.                 | Feet.  |
| Unrecorded .....  | 557                   | 557    |
| Pittsburgh coal .....   | ..                    | 557    |
| Unrecorded .....  | 794                   | 1351   |
| Salt sand, (water, 1520') .....   | 211                   | 1562   |
| Unrecorded .....  | 302                   | 1864   |
| Big Injun sand .....  | 136                   | 2000   |
| Unrecorded .....  | 897                   | 2897   |
| Fifth sand (gas, 2907'-2919') and unrecorded to bottom..                  | 28                    | 2925   |
| 10" casing, 620'; 8¼" casing, 1270'; 6½" casing, 1618'; 3" tubing, 2925'. |                       |        |
| Pressure test in 3" tubing:   |                       |        |
| 1st ½ minute, 260 lbs.  | 4th minute, 625 lbs.  |        |
| 1st minute, 360 lbs.  | 5th minute, 650 lbs.  |        |
| 2nd minute, 470 lbs.  | 60th minute, 685 lbs. |        |
| 3rd minute, 565 lbs.  |                       |        |

**L. B. Brand No. 1 Well Record (296).**

Grant district, 2.1 miles N., 70° E. of Hagans. Authority, West Virginia Traction & Electric Company. Completed Oct. 18, 1906.

|   | Thickness. | Total. |
|---|------------|--------|
|   | Feet.      | Feet.  |
| Unrecorded .....  | 424        | 424    |
| Coal, Pittsburgh .....  | ..         | 424    |
| Unrecorded .....  | 439        | 963    |
| Dunkard sand and unrecorded .....   | 242        | 1205   |
| Salt sand .....   | 160        | 1370   |
| Unrecorded .....  | 256        | 1626   |
| Big Lime .....  | 58         | 1684   |
| Unrecorded and Maxton sand .....  | 31         | 1715   |
| Unrecorded .....  | 47         | 1762   |
| Big Injun sand (pay, 1859') .....   | 80         | 1842   |
| Unrecorded .....  | 343        | 2185   |
| Berea Grit (gas show, 2248') .....  | 24         | 2209   |
| Unrecorded .....  | 40         | 2249   |
| Gantz sand .....  | 41         | 2290   |
| Unrecorded .....  | 15         | 2305   |
| Fifty-foot sand .....   | 110        | 2415   |
| Unrecorded .....  | 130        | 2535   |
| Sand, (Gordon Stray) .....  | 20         | 2555   |
| Unrecorded .....  | 18         | 2573   |
| Gordon sand .....   | 17         | 2590   |
| Unrecorded .....  | 200        | 2790   |
| Fifth sand and unrecorded to bottom .....   | 171        | 2961   |
| • 2" tubing, 1798'.   |            |        |
| "Shot with 30 quarts in Injun; shot with 30 quarts in Gantz. Did not improve well." |            |        |

## Jehu Davis No. 1 Well Record (297).

Grant district, 2.2 miles northeast of Hagans. Authority, Hope Natural Gas Company.

| (Elevation, 1490' B.-A. T.)  | Thickness. | Total             |
|--|------------|-------------------|
|  | Feet.      | Feet.             |
| Unrecorded .....   | 450        | 450               |
| Coal, (Waynesburg) .....   | 6          | 456               |
| Unrecorded .....   | 272        | 728               |
| Coal, Mapietown (Sewickley) .....  | 7          | 735               |
| Unrecorded .....   | 76         | 811               |
| Coal, Pittsburgh .....   | 10         | 821               |
| Unrecorded .....   | 19         | 840               |
| Sand .....   | 30         | 870               |
| Unrecorded .....   | 480        | 1350              |
| Sand, (Big Dunkard) (gas, 9/10" mercury in 2" tubing<br>1356') .....               | 20         | 1370              |
| Unrecorded .....   | 370        | 1740              |
| Salt sand (hole full of water, 1775') .....  | 65         | 1805              |
| Unrecorded .....   | 213        | 2018              |
| Little Lime .....  | 10         | 2028              |
| Pencil cave .....  | 24         | 2052              |
| Big Lime .....   | 84         | 2136              |
| Sand .....   | 91         | } Big Injun ..... |
| Unrecorded .....   | 5          |                   |
| Sand .....   | 20         |                   |
| Unrecorded .....   | 80         | 2332              |
| Sand, (Squaw) .....  | 33         | 2365              |
| Unrecorded .....   | 292        | 2657              |
| Sand, (Berea) .....  | 33         | 2690              |
| Unrecorded .....   | 10         | 2700              |
| Sand, (Gantz) .....  | 57         | 2757              |
| Unrecorded .....   | 75         | 2832              |
| Thirty-foot sand .....   | 13         | 2845              |
| Unrecorded .....   | 77         | 2922              |
| Gordon Stray sand .....  | 10         | 2932              |
| Unrecorded (no Gordon sand) .....  | 68         | 3109              |
| Fourth sand .....  | 15         | 3115              |
| Unrecorded .....   | 38         | 3153              |
| Fifth sand (gas show, 3177'; pay, 3187'; 2/10" mercury in<br>5 3/16" casing) ..... | 41         | 3194              |
| Unrecorded to bottom .....   | 33         | 3227              |

The mercury gage test given for the Big Dunkard sand is equivalent to a daily gas production of 500,000 cu. ft., and that for the Fifth sand, to 1,670,000 cu. ft. daily.

**J. N. Michael No. 1998 Well Record (300).**

Grant district, 1.8 miles northeast of Hagans. Authority, Hope Natural Gas Company. Completed Oct. 11, 1911.

| (Elevation, 1305' B.-A. T.)  | Thickness Total. |       |
|--|------------------|-------|
|  | Feet.            | Feet. |
| Conductor .....  | 16               | 16    |
| Unrecorded .....   | 299              | 315   |
| Coal, native (Waynesburg) .....  | 4                | 319   |
| Unrecorded .....   | 355              | 674   |
| Pittsburgh coal .....  | 8                | 682   |
| Unrecorded .....   | 890              | 1572  |
| Third Salt sand (water, 1685') .....   | 116              | 1688  |
| Unrecorded .....   | 105              | 1793  |
| Maxton sand .....  | 22               | 1815  |
| Unrecorded .....   | 65               | 1880  |
| Little Lime .....  | 12               | 1892  |
| Pencil cave .....  | 9                | 1901  |
| Big Lime .....   | 62               | 1963  |
| Big Injun sand (gas, 2158', 2165'-2225') .....   | 141              | 2104  |
| Unrecorded .....   | 900              | 3004  |
| Fifth sand (gas, 3009') .....  | 61               | 3065  |
| Unrecorded to bottom .....   | 112              | 3177  |
| 10" casing, 724'; 8½" casing, 1541'; 6 5/8" casing, 1911'; 5 3/16" casing (steel line measurement), 2780'. |                  |       |
| Shot Oct. 12, 1911, with 15 quarts; top of shot, 3009'.  |                  |       |

**J. N. Michael No. 1 Well Record (301).**

Grant district, 1.6 miles northeast of Hagans. Authority, Hope Natural Gas Company. Completed Feb. 2, 1911.

| (Elevation, 1330' B.-A. T.)  | Thickness Total. |       |
|--|------------------|-------|
|  | Feet.            | Feet. |
| Conductor .....  | 16               | 16    |
| Unrecorded .....   | 228              | 244   |
| Coal, native (Waynesburg "A") (steel line measurement) .....   | 6                | 250   |
| Unrecorded .....   | 434              | 684   |
| Pittsburgh coal (steel line measurement) .....   | 8                | 692   |
| Unrecorded .....   | 1225             | 1917  |
| Big Lime .....   | 73               | 1990  |
| Big Injun sand (gas, 2067'-2079'; 12/10 water in 2" pipe; gas, 2087'-2095') .....  | 45               | 2135  |
| Unrecorded .....   | 889              | 3024  |
| Fifth sand (gas, 3040'; 4/10 mercury in 2" pipe) (steel line measurement) .....  | 51               | 3075  |
| Unrecorded to bottom .....   | 136              | 3211  |
| "10" casing, 737'; 8½" casing, 1560'; 6 5/8" casing, 1927'; 5 3/16" casing, 2796'; 2" tubing, 3163'. Packer set at 2790'." |                  |       |

The gage test given above for the Fifth sand gas is equivalent to 350,000 cu. ft. daily, and that for the Big Injun, 165,000 cu. ft. daily.

**J. N. Michael No. 2 Well Record (302).**

Grant district, 1.9 miles northeast of Hagans. Authority, Carnegie Natural Gas Company. Completed July 9, 1911.

| (Elevation, 1175' B.-A. T.)  | Thickness. | Total. |
|--|------------|--------|
|  | Feet.      | Feet.  |
| Unrecorded .....   | 495        | 495    |
| Pittsburgh coal .....  | 5          | 500    |
| Unrecorded .....   | 1300       | 1800   |
| Big Injun sand .....   | 134        | 1934   |
| Unrecorded .....   | 916        | 2850   |
| Fifth sand (gas, 2873') .....  | 31         | 2881   |
| Unrecorded to bottom .....   | 6          | 2887   |
| 10" casing, 504'; 8½" casing, 1145'; 6 5/8" casing, 1751'; 3" tubing, 2887'. |            |        |

First pressure test in 3" tubing:

|                        |                       |
|------------------------|-----------------------|
| 1st ½ minute, 125 lbs. | 4th minute, 450 lbs.  |
| 1st minute, 200 lbs.   | 5th minute, 490 lbs.  |
| 2nd minute, 295 lbs.   | 10th minute, 530 lbs. |
| 3rd minute, 380 lbs.   | 60th minute, 585 lbs. |

**J. N. Michael No. 3 Well Record (305).**

Grant district, 1.7 miles N., 75° E. of Hagans. Authority, Carnegie Natural Gas Company. Completed Dec. 4, 1911.

| (Elevation, 1265' B.-A. T.)  | Thickness. | Total. |
|--|------------|--------|
|  | Feet.      | Feet.  |
| Unrecorded .....   | 730        | 730    |
| Pittsburgh coal .....  | 6          | 736    |
| Big Injun sand (gas, 2025', 2135', and 2160') and unrecorded to bottom ..... | 1436       | 2172   |

First pressure test in 6 5/8" casing:

|                       |                         |
|-----------------------|-------------------------|
| 1st ½ minute, 25 lbs. | 6th minute, 107 lbs.    |
| 1st minute, 35 lbs.   | 8th minute, 124 lbs.    |
| 2nd minute, 50 lbs.   | 10th minute, 135 lbs.   |
| 3rd minute, 70 lbs.   | 25th minute, 175 lbs.   |
| 4th minute, 85 lbs.   | Rock pressure, 260 lbs. |
| 5th minute, 90 lbs.   |                         |

The original rock pressure of Big Injun gas in this pool on the Clay district side of the line was over 500 pounds to the square inch.

**Alpheus Morris (No. 3) Well Record (306).**

Grant district, 1.6 miles northeast of Hagans. Authority, West Virginia Traction & Electric Company. Completed Dec. 23, 1911.

| (Elevation, 1280' B.-A. T.)                 | Thickness. | Total. |
|---|------------|--------|
|   | Feet.      | Feet.  |
| Conductor .....                             | 15         | 15     |
| Slate, shells, lime and sand, no coal ..... | 493        | 508    |
| Sewickley coal .....                        | 7          | 515    |

|   | Thickness.<br>Feet. | Total.<br>Feet. |
|---|---------------------|-----------------|
| Slate, white .....  | 15                  | 530             |
| Lime .....  | 40                  | 570             |
| Slate, black .....  | 22                  | 592             |
| Pittsburgh coal .....   | 8                   | 600             |
| Slate, lime, sand, red rock and sand in layers, no coal...                                | 500                 | 1100            |
| Big Dunkard (gas, 1115' and 1145') .....  | 45                  | 1145            |
| Slate, shells and sandstone in layers, no coal .....                                      | 350                 | 1495            |
| Lower Salt sand (water, 1573') .....  | 105                 | 1600            |
| Black sand .....  | 25                  | 1625            |
| Slate and shells .....  | 25                  | 1650            |
| Red rock .....  | 20                  | 1670            |
| Slate, black .....  | 30                  | 1700            |
| Maxton sand .....   | 40                  | 1740            |
| Slate, black .....  | 15                  | 1755            |
| Slate and shells .....  | 35                  | 1790            |
| Little Lime .....   | 17                  | 1807            |
| Pencil cave .....   | 16                  | 1823            |
| Big Lime (break, 1835'-1839') .....   | 82                  | 1905            |
| Big Injun sand (gas, 1983', 2000') .....  | 140                 | 2045            |
| Slate and shells .....  | 55                  | 2100            |
| Sand, (Squaw) .....   | 60                  | 2160            |
| Slate and shells .....  | 165                 | 2325            |
| Berea Grit .....  | 30                  | 2355            |
| Slate and shells .....  | 80                  | 2435            |
| Gantz sand (gas, 2445') .....   | 45                  | 2480            |
| Slate and shells .....  | 23                  | 2503            |
| Fifty-foot sand .....   | 67                  | 2570            |
| Slate and shells .....  | 15                  | 2585            |
| Sand, red (Thirty-foot) .....   | 35                  | 2620            |
| Slate and shells, red .....   | 81                  | 2701            |
| Gordon Stray sand .....   | 16                  | 2717            |
| Slate and shells, red .....   | 108                 | 2825            |
| Slate and shells, black .....   | 45                  | 2870            |
| Fourth sand .....   | 34                  | 2904            |
| Slate and shells, white .....   | 39                  | 2943            |
| Fifth sand .....  | 28                  | 2971            |
| Slate to bottom .....   | 9                   | 2980            |
| 10" casing, 627'7"; 8½" casing, 1578'10"; 6 5/8" casing, 1859';<br>5 3/16" casing, 2710'. |                     |                 |

## Eugene Snyder No. 1 Well Record (295).

Grant district, 2.3 miles northeast of Hagans. Authority, Hope Natural Gas Company. Completed Nov. 11, 1905.

|                                   | Thickness.<br>Feet. | Total.<br>Feet. |
|-----------------------------------|---------------------|-----------------|
| Unrecorded .....                  | 60                  | 60              |
| Coal, (Waynesburg) .....          | 5                   | 65              |
| Unrecorded .....                  | 15                  | 80              |
| Coal, (Little Waynesburg) .....   | 5                   | 85              |
| Unrecorded .....                  | 280                 | 365             |
| Coal, Mapletown (Sewickley) ..... | 7                   | 372             |
| Unrecorded .....                  | 65                  | 437             |
| Coal, Pittsburgh .....            | 9                   | 446             |

|   | Thickness. | Total. |
|---|------------|--------|
|   | Feet.      | Feet.  |
| Unrecorded .....  | 750        | 1196   |
| Gas sand (gas, 1205') .....   | 94         | 1290   |
| Unrecorded .....  | 15         | 1305   |
| Salt sand (water, 1 baller, 1310') .....  | 65         | 1370   |
| Unrecorded .....  | 10         | 1380   |
| Second Salt sand (water, 6 ballers, 1436') .....  | 66         | 1446   |
| Unrecorded .....  | 214        | 1660   |
| Big Lime .....  | 90         | 1750   |
| Big Injun sand (gas, 1875' steel line measurement.) ....  | 158        | 1908   |
| Unrecorded .....  | 895        | 2803   |
| Fifth sand (gas, 2823', steel line measurement) .....   | 29         | 2832   |
| Unrecorded .....  | 11         | 2843   |
| Sand, (Bayard) .....  | 19         | 2862   |
| Unrecorded to bottom, (steel line measurement) .....  | 30         | 2892   |
| 13½" casing, 24'; 10" casing, 461'; 8¼" casing, 1270'; 6 5/8" casing, 1670'; 5 3/16" casing, 2212'. |            |        |
| Shot Nov. 11, 1895, with 20 quarts; 3½"x10' shell with 60' anchor.                                  |            |        |

### J. C. Brand No. 2 Well Record (294).

Grant district, 2 miles southwest of Cassville. Authority, West Virginia Traction & Electric Company. Completed Nov. 20, 1907.

|  | Thickness. | Total. |
|--|------------|--------|
|  | Feet.      | Feet.  |
| Sandy lime and slate, no coal .....  | 240        | 240    |
| Bluff sand .....   | 60         | 320    |
| Coal, Mt. Morris (Waynesburg) .....  | 7          | 327    |
| Slate, sand and lime in layers, no coal .....                                      | 248        | 575    |
| Mapletown (Sewickley) coal.....  | 6          | 581    |
| Slate .....  | 35         | 616    |
| Lime .....   | 12         | 628    |
| Slate .....  | 7          | 635    |
| Lime .....   | 14         | 649    |
| Black slate .....  | 6          | 655    |
| Lime .....   | 10         | 655    |
| Coal, Pittsburgh .....   | 9          | 674    |
| Slate, shale, red rock, sand and red rock in layers,<br>no coal .....              | 1231       | 1905   |
| Big Lime .....   | 70         | 1975   |
| Big Injun sand (first pay, 2056'; second, 2062') and<br>unrecorded to bottom ..... | 176        | 2151   |
| 10" casing, 717'; 8¼" casing, 1330'.. 6 5/8" casing, 1718'; 5 3/16" casing, 1992'. |            |        |

The two following records are from wells in the northern edge of Grant district, in which light pays of gas were encountered in the Big Injun and Gantz sands. Both were drilled below the Bayard sand and preclude the extension into this district of a possible Bayard sand oil pool southward from the Jas. Kennedy No. 1 well (264) on Scott run:

## L. S. Bircher No. 1 Well Record (291).

Grant district, 1.4 mile southeast of Cassville. Authority, West Virginia Traction & Electric Company. Completed in 1909.

|   | Thickness. | Total. |
|---|------------|--------|
| (Elevation, 1335' B-A. T.)                              | Feet.      | Feet.  |
| Slate, etc. ....  | 112        | 112    |
| Sand .....  | 58         | 170    |
| Mt. Morris (Waynesburg) coal .....                      | 6          | 176    |
| Slate, lime, shale and sand in layers, no coal .....    | 353        | 465    |
| Mapletown, (Sewickley) coal .....                       | 7          | 472    |
| Slate .....   | 20         | 492    |
| Lime .....  | 17         | 509    |
| Slate and shale .....                                   | 28         | 537    |
| Lime .....  | 18         | 555    |
| Slate .....   | 8          | 563    |
| Pittsburgh coal .....                                   | 9          | 572    |
| Slate, lime, red rock and sand in layers, no coal ..... | 1226       | 1798   |
| Lime .....  | 19         | 1817   |
| Black slate .....                                       | 8          | 1825   |
| Big Lime .....  | 75         | 1900   |
| Big Injun sand (pay, 1972') .....                       | 100        | 2000   |
| Slate and shale .....                                   | 36         | 2036   |
| Sand .....  | 30         | 2066   |
| Slate .....   | 19         | 2085   |
| Sand .....  | 40         | 2125   |
| Slate and shale .....                                   | 35         | 2160   |
| Sand, (Squaw) .....                                     | 30         | 2190   |
| Slate and shale .....                                   | 70         | 2260   |
| Lime and sand .....                                     | 27         | 2287   |
| Slate .....   | 42         | 2329   |
| Slate and shale .....                                   | 38         | 2367   |
| Lime and sand .....                                     | 25         | 2392   |
| Slate and shale .....                                   | 22         | 2414   |
| Sand, (Gantz) (gas pay, 2417') .....                    | 59         | 2473   |
| Slate .....   | 17         | 2490   |
| Sand, (Fifty-foot) .....                                | 38         | 2528   |
| Red rock .....  | 35         | 2563   |
| Slate and shale .....                                   | 46         | 2609   |
| Red rock .....  | 83         | 2692   |
| Sand shales, (Gordon) .....                             | 47         | 2739   |
| Slate .....   | 33         | 2772   |
| Lime and sand, (Fourth) .....                           | 30         | 2802   |
| Slate and shales .....                                  | 60         | 2862   |
| Sand shales, (Fifth) .....                              | 48         | 2910   |
| Slate .....   | 22         | 2932   |
| Sand (Bayard) .....                                     | 76         | 3008   |
| Slate and shales to bottom .....                        | 58         | 3066   |

10" casing, 600'6"; 8" casing, 1151'; 6½" casing, 1603'; 5" casing, 1900".



## Sanford Barrickman No. 1 Well Record (290).

Grant district, 1.8 miles southeast of Cassville. Authority, West Virginia Traction & Electric Company.

| (Elevation, 1085 B-A. T.)                            | Thickness. | Total. |
|--|------------|--------|
|  | Feet.      | Feet.  |
| Slate and shales, and lime in layers .....           | 178        | 178    |
| Coal, Sewickley .....                                | 6          | 184    |
| Slate shale .....                                    | 23         | 207    |
| Lime .....   | 12         | 219    |
| Sand .....   | 7          | 226    |
| Slate .....  | 17         | 243    |
| Lime .....   | 11         | 254    |
| Slate .....  | 14         | 268    |
| Sand .....   | 5          | 273    |
| Pittsburgh coal .....                                | 8          | 281    |
| Slate, lime, red rock, sand in layers, no coal ..... | 705        | 986    |
| Coal, (Upper Kittanning).....                        | 5          | 991    |
| Slate and shale .....                                | 45         | 1036   |
| Lime .....   | 7          | 1043   |
| Black slate .....                                    | 13         | 1056   |
| Gas sand .....                                       | 40         | 1096   |
| Black slate .....                                    | 17         | 1113   |
| Sand, Salt? (II Cow Run) .....                       | 92         | 1205   |
| Slate .....  | 18         | 1223   |
| Sand (Salt) .....                                    | 60         | 1283   |
| Slate and shale .....                                | 75         | 1358   |
| Red rock, slate, shale and red rock .....            | 165        | 1523   |
| Big Lime .....                                       | 60         | 1583   |
| Broken sandy lime .....                              | 42         | 1625   |
| Big Injun sand (gas show, 1697') .....               | 113        | 1738   |
| Slate and shale .....                                | 30         | 1768   |
| Squaw sand .....                                     | 28         | 1796   |
| Slate and shale .....                                | 125        | 1921   |
| Lime sand .....                                      | 40         | 1961   |
| Slate and shale .....                                | 75         | 2036   |
| Sandy lime .....                                     | 27         | 2063   |
| Slate and shale .....                                | 130        | 2193   |
| Sandy lime .....                                     | 23         | 2216   |
| Slate .....  | 14         | 2230   |
| Fifty-foot sand .....                                | 57         | 2287   |
| Break .....  | 13         | 2300   |
| Sand, (Thirty-foot) .....                            | 40         | 2340   |
| Red rock .....                                       | 35         | 2375   |
| Lime sand, (Gordon Stray) .....                      | 18         | 2393   |
| Slate and shale .....                                | 25         | 2418   |
| Red lime .....                                       | 30         | 2448   |
| Slate .....  | 12         | 2460   |
| Lime .....   | 10         | 2470   |
| Slate .....  | 12         | 2482   |
| Sand (Fourth) .....                                  | 30         | 2512   |
| Slate .....  | 16         | 2528   |
| Red rock .....                                       | 4          | 2532   |
| Sand, (Fourth) .....                                 | 28         | 2560   |
| Slate .....  | 30         | 2590   |
| Sand, (Fifth) .....                                  | 26         | 2616   |

|   | Thickness. Total. |       |
|---|-------------------|-------|
|   | Feet.             | Feet. |
| Slate .....   | 33                | 2649  |
| Sand, (Bayard) .....  | 52                | 2701  |
| Slate and shale .....   | 84                | 2785  |
| 10" casing, 475'; 8" casing, 873'; 6 5/8" casing, 1400'; 5 3/16" casing, 1641'. |                   |       |

Two miles southeastward a dry hole (317) was drilled on the **J. W. Holland** farm by Messrs. Courtney & McDermott on a branch of Dents run, the detailed log of which is published on pages 134-135 of Vol. I(A) of the State Survey reports. This well penetrated 175 feet below the Bayard sand, and starts 55 feet by hand-level below the Pittsburgh coal.

One mile west of Morgantown the **Peninsula Company No. 1 well (318)** was drilled to a depth of about 1200 feet a short distance west of the crest of the Indiana anticline, in which a light show of gas was encountered. The well starts 65 feet by hand-level below the Harlem coal, according to Reger; hence it must have stopped near the base of the Big Injun, since the latter coal in this region belongs about 320 feet below the Pittsburgh coal. The gas pay was too light to be utilized by the owners—the Mississippi Glass Company.

Three miles southwestward the Round Bottom Oil & Gas Company drilled practically a **dry hole (316)** during 1910 on the **Jesse Camp** farm, 0.6 miles northwest of Round Bottom station. The well starts about 50 feet below the Pittsburgh coal and reached a depth of slightly over 2000 feet, according to S. G. Yoke of Morgantown, an interested party.

The **Ben J. Miller No. 1 well (312)**, located in the extreme western point of Grant district, near the head of Craig run, is a light gasser. It was not learned in what sand the gas pay was encountered.

**Prospective Oil and Gas Areas, Grant District.**—The developed gas fields of both Cass and Grant districts, Monongalia county, lying southeast up the structural slope from the Mt. Morris-Fairview oil belt, appear to occur in more or less congested pools along this slope without relation to any special interruption of this slope with the possible exception of the pool west of Bowlby, while other territory apparently as well located from the standpoint of development and structure

is barren. This leads to the conclusion that the producing sands therein are quite irregular and not always porous, thus making it quite difficult for the geologist to point out good or bad territory. Hence, with the exception of the region on the head of Little Indian creek, drilling operations in Grant have not led to very encouraging results. However, there are several large areas therein that are so favored by structure as to warrant the drilling of more test wells. Taking up the discussion of these areas roughly from west to east, (1), that portion of the district lying northwest of Georgetown and Arnettville on the waters of Snider and Stewart runs from a structural standpoint would justify the drilling of two or three test wells for Big Injun gas and Fifth sand oil; (2) that, southward from Flaggy Meadow run to the Monongalia-Marion county line between the 700 and 800-foot contours of the Pittsburgh coal as outlined on Map II, appears favorable for gas in the Big Injun and Fifth; (3) that along the crest of the Indiana anticline from the Monongahela river at Westover to the same stream at Uffington for gas in the Big Injun and Berea sands in view of the showings encountered at these horizons in wells Nos. 318 and 332 in Morgantown and one mile west thereof; and (4) that, at Little Falls from the river west to the 1375-foot contour of the Pittsburgh coal, for gas in the same sands.

### *Union District.*

Union district, Monongalia county, lies immediately east of the Monongahela river, south of Pennsylvania, west of Preston county and northeast of Morgan district; hence, its area is traversed in a northeast-southwest direction by three structural folds; viz., the Indiana and Chestnut Ridge anticlines, and the Connellsville (Uniontown) syncline, so that its strata are very much warped and twisted. The elevation of the Pittsburgh coal horizon therein varies from about 1070' A. T. at the State line, 0.7 mile southwest of Cheat Haven, Pa., to over 2500' A. T. in the extreme northeast corner of the district. Eight wells have been drilled within the boundaries of Union—2 on the west side of Cheat river and 6

on the east side, and only one paying well (323)—a gasser at Van Voorhis—has been obtained; in fact, this is the only paying well ever drilled on the east side of the Monongahela river in Monongalia county.

Taking up the drilling operations in the district from west to east, the **VanVoorhis-Bailey No. 1 well (323)**, located at VanVoorhis was drilled several years ago by what is now the West Virginia Traction and Electric Company. According to Hon. E. M. Grant, it was drilled to a depth of about 1150 feet. The Big Injun sand was 130 feet thick but quite shelly with three or four light gas pays 110 feet in the sand. A pressure test in 2-inch tubing gave 80 pounds to the square inch for the first minute, and 350 pounds for the rock pressure. The initial volume of the well was estimated at one-half million cubic feet daily. This was mentioned above as the only paying well on the east side of the Monongahela in the county.

One mile southeastward the Randall Gas & Water Company during 1912 drilled practically a dry hole just west of the crest of the Indiana arch, the log of which as furnished the Survey by W. H. South, Manager, is as follows with slight modifications in parentheses by the writer:

#### D. M. Hoard No. 1 Well Record (322A).

Union district, 0.8 mile southeast of VanVoorhis. Authority, Randall Gas and Water Company.

|   | Thickness. Total |       |
|---|------------------|-------|
|   | Feet.            | Feet. |
| Conductor box (surface gravel) .....            | 18.5             | 18.5  |
| Unrecorded (water at 40') .....                 | 101.5            | 120   |
| Sand, Murphy .....                              | 20               | 140   |
| Unrecorded .....                                | 150              | 290   |
| Sand .....                                      | 10               | 300   |
| Unrecorded .....                                | 100              | 400   |
| Coal, (Brush Creek) .....                       | 3                | 403   |
| Unrecorded .....                                | 58               | 461   |
| Sand, Big Dunkard .....                         | 33               | 494   |
| Coal, Upper Freeport .....                      | 5                | 499   |
| Unrecorded .....                                | 67               | 566   |
| Gas sand .....                                  | 79               | 645   |
| Unrecorded .....                                | 83               | 728   |
| Coal, (Clarion) .....                           | 4                | 732   |
| Unrecorded .....                                | 27               | 759   |
| Sand, (II Cow Run and Salt) water at 796' ..... | 193              | 952   |
| Unrecorded .....                                | 168              | 1120  |

|   | Thickness.<br>Feet. | Total.<br>Feet. |
|---|---------------------|-----------------|
| Little Lime .....   | 34                  | 1154            |
| Unrecorded .....  | 17                  | 1171            |
| Big Lime .....  | 52                  | 1223            |
| Slate and shells .....  | 35                  | 1258            |
| Big Injun sand (gas, small at 1323') .....                      | 98                  | 1356            |
| Unrecorded to bottom .....                                      | 105.5               | 1461.5          |
| · 10" casing, 334'; 8½" casing, 774'; and 6 5/8" casing, 1175'. |                     |                 |

"Tubed well for Mr. Hoard; pulled all casing and abandoned well as the volume was not sufficient for commercial use."

This well starts 60 to 90 feet below the Pittsburgh coal horizon, hence the above coal correlations are correct, but the thicknesses of the seams are probably excessive as will appear from the logs of the coal test borings along West run, herein published. Mr. South estimates the volume of the gas pay encountered at 20,000 cu. ft. daily.

During 1910 James Kuntz, Jr. & Co. of Washington, Penna., drilled a dry hole on the east bank of Cheat river in Union district, 1.5 miles due south of Stewartstown, the following log of which with slight modifications in parentheses was furnished the Survey by Hon. E. M. Grant of Morgantown. The well starts 50 feet by hand-level below the Elk Lick coal, or about 290 feet below the Pittsburgh bed:

#### Ed White No. 1 Well Record (324).

Union district, 0.5 mile north of Jaco. Authority, James Kuntz, Jr., & Company.

| (Elevation, 840' B-A. T.)               | Thickness.<br>Feet. | Total.<br>Feet. |
|---|---------------------|-----------------|
| Conductor .....                         | 27                  | 27              |
| Lime and shale.....                     | 78                  | 105             |
| Coal, (Bakerstown) .....                | ..                  | 105             |
| Lime and shale .....                    | 18                  | 123             |
| Sandstone and lime .....                | 33                  | 156             |
| Shale .....                             | 9                   | 165             |
| Sandstone, (Buffalo) .....              | 45                  | 210             |
| Lime and shale .....                    | 33                  | 243             |
| Sandstone, with water, (Mahoning) ..... | 57                  | 300             |
| Coal, Upper Freeport .....              | ..                  | 300             |
| Unrecorded and sandstone .....          | 14                  | 314             |
| Shale, black and brown .....            | 79                  | 393             |
| Lime, (Johnstown Cement.) .....         | 10                  | 403             |
| Sand .....                              | 71                  | 474             |
| Shale, brown .....                      | 16                  | 490             |
| Lime .....                              | 10                  | 500             |
| Shale .....                             | 20                  | 520             |

|  | Thickness. | Total. |
|--|------------|--------|
|  | Feet.      | Feet.  |
| Coal, (Lower Kittanning) .....           | ..         | 520    |
| Lime and shale .....                     | 30         | 550    |
| Coal streak, (Clarion).....              | ...        | 550    |
| Shale, black and brown .....             | 60         | 610    |
| Sand, "Salt" .....                       | 100        | 710    |
| (hole full of water)                     |            |        |
| Slate .....                              | 95         | 805    |
| Blue sandy lime .....                    | 85         | 890    |
| Slate .....                              | 10         | 900    |
| Red rock .....                           | 54         | 954    |
| Lime .....                               | 16         | 970    |
| Red rock .....                           | 28         | 998    |
| Big Lime .....                           | 87         | 1085   |
| Red rock .....                           | 15         | 1100   |
| Big Injun sand (upper 185' shelly) ..... | 320        | 1420   |
| Slate and shells .....                   | 180        | 1600   |
| Lime and slate .....                     | 60         | 1660   |
| Sand, (Gantz) .....                      | 60         | 1720   |
| Unrecorded .....                         | 35         | 1755   |
| Sand (Fifty-foot) .....                  | 10         | 1765   |
| Slate and red rock .....                 | 40         | 1805   |
| Sand and lime .....                      | 82         | 1887   |
| Lime and red rock .....                  | 98         | 1985   |
| Shale and red rock .....                 | 82         | 2067   |
| Lime and shells .....                    | 10         | 2077   |
| Sand, (Fourth) .....                     | 23         | 2100   |
| Slate and shells .....                   | 20         | 2120   |
| Sand, (Fifth) .....                      | 30         | 2150   |
| Slate and shells .....                   | 25         | 2175   |
| Unrecorded .....                         | 10         | 2185   |
| Sand, (Bayard) gas show .....            | 50         | 2235   |
| Slate and shells .....                   | 15         | 2250   |
| Lime, shells, etc. ....                  | 357        | 2607   |

10" casing, 287'; 8¼" casing, 785'.

"Casing pulled and hole plugged to protect sands.

"Dry hole; sands regular, and very light show of gas at 2175'-2235'.

The detailed log of the Francis Costolo No. 1 well (326), located 3¼ miles northeastward at the mouth of Morgan run, is published in connection with the section for the latter place, page 105. A showing of oil in the Big Injun sand was reported in this well. This record as well as that of the White well above, reveals a marked increase in the intervals from the Pittsburgh coal down to the Big Injun and deeper sands over the same in that portion of the county west of the Monongahela river, due largely to the southeastward thickening of the Pottsville and Mauch Chunk measures.

In this same region the **F. Costolo No. 1 well (327)**, located at the mouth of Rubles run, was drilled in the year 1865 to a depth of about 600 feet. A showing of oil was reported in this well, but it was not learned at what depth. During the same year the **Samuel Holt Heirs No. 1 well (329)**, located on Rubles run, just across the State line in Pennsylvania, was drilled to a depth of about 500 feet, in which a showing of gas was encountered.

One-fourth mile southward a light showing of gas was struck in the **Thos. Manning No. 1 well (325)**. The horizon of the gas pay and the total depth of the well was not ascertained.

The **Chess Bros. No. 1 well (330)**, located one mile northeast of Laurel Iron Works P. O., is reported as drilled by the South Penn Oil Company about 18 years ago to a depth of 2200 feet. The well was considered a dry hole. A strong stream of fresh water with a slight scum of oil was flowing from the well mouth when visited by the writer in January, 1910.

The log of the **Ley No. 1 dry hole (330A)**, located on the east bank of Cheat river, 0.3 mile southeast of Mont Chateau, is published in connection with the Quarry Run Section, page 108.

**Prospective Oil and Gas Areas, Union District.**—The foregoing is a complete list of drilling operations for oil and gas in Union district from which it is quite evident that the operator has not met therein with encouraging results. This is due in large measure to the fact that the most of the area of the district lies on the steeply pitching western slope of the great Chestnut Ridge anticline, or in a region where the fracturing of the strata has been carried on to such an extent that all the original stores of oil and gas that may have once existed therein have probably escaped into the air through defective covers, rendering it useless to drill in this locality to any ordinary depth. However, in the western portion of the district the folding is not nearly so pronounced, so that there is some territory in that locality which would warrant the drilling of further test wells. (1) That area lying immediately along the crest of the Indiana anticline from the State line southward to

the latitude of VanVoorhis, appears favorable for Big Injun gas; and (2) since the sands below the Big Injun are non-water bearing in this portion of the State, that territory lying immediately along the axis of the Connellsville syncline northeastward from Easton to the State line is favorably located from a structure standpoint for oil in the deep sands. However, the absence of gas in paying quantities in wells both to the east and west of this belt in the sands below the Big Injun and the dry hole (324) on the Ed White farm in this Basin on the east bank of Cheat renders the territory extremely problematical; in other words certain areas may be very favorably located with reference to structure for oil or gas, yet the causes leading to the genesis of these valuable hydro-carbons may never have prevailed in that region. Hence, the province of the geologist is not so much to point out producing territory as it is to discourage useless drilling.

***Morgan District.***

Morgan district, Monongalia county, lies immediately southwest of Union district and east of the Monongahela river, and is traversed by the same structural folds as the latter area; hence, practically the same structural conditions prevail in Morgan as in Union. Only seven wells have been drilled within its boundaries for oil and gas, all of which have proved non-paying for commercial purposes. Taking up the discussion of the logs of these wells from northwest to southeast across the district, the following is the record of a well completed during 1912 by the Randall Gas & Water Company on the south bank of West run, 1 mile southward from VanVoorhis, the log of which was furnished the Survey by W. H. South, Manager. The well mouth is about 280 feet below the horizon of the Pittsburgh coal:

**Wayne Wilson No. 1 Well Record (321A).**

|                                      | Thickness. | Total. |
|--------------------------------------|------------|--------|
|                                      | Feet.      | Feet.  |
| (Elevation, 925' B-A. T.)            |            |        |
| Conductor box (surface gravel) ..... | 14         | 14     |
| Red rock .....                       | 5          | 19     |
| Lime .....                           | 15         | 34     |



|   | Thickness.<br>Feet. | Total.<br>Feet. |
|---|---------------------|-----------------|
| Slate                                   | 15                  | 49              |
| Lime (water, hole full at 95')          | 50                  | 99              |
| Slate, white                            | 26                  | 125             |
| Lime                                    | 15                  | 140             |
| Red rock                                | 6                   | 146             |
| Slate, dark                             | 5                   | 151             |
| Lime                                    | 29                  | 180             |
| Red rock                                | 5                   | 185             |
| Lime                                    | 25                  | 210             |
| Slate                                   | 30                  | 240             |
| Coal, some gas, (Brush Creek)           | 4                   | 244             |
| Lime                                    | 41                  | 285             |
| Slate, dark                             | 5                   | 290             |
| Lime                                    | 10                  | 300             |
| Slate, white                            | 5                   | 305             |
| Dunkard sand (Big Dunkard)              | 30                  | 335             |
| Freeport coal, (Upper Freeport)         | 5                   | 340             |
| Slate, black                            | 10                  | 350             |
| Slate, white                            | 20                  | 370             |
| Lime                                    | 25                  | 395             |
| Slate, white                            | 13                  | 408             |
| Lime, hard                              | 8                   | 416             |
| Coal (some gas), Upper Kittanning       | 4                   | 420             |
| Slate, dark                             | 10                  | 430             |
| Gas sand                                | 55                  | 485             |
| Slate, black                            | 9                   | 494             |
| Coal, (Lower Kittanning)                | 3                   | 497             |
| Slate                                   | 17                  | 514             |
| Sand, black, (Clarion)                  | 10                  | 524             |
| Coal, (Clarion)                         | 3                   | 527             |
| Slate                                   | 10                  | 537             |
| Lime                                    | 8                   | 545             |
| Sand, baller full of water (II Cow Run) | 20                  | 565             |
| Slate                                   | 30                  | 595             |
| Salt sand (hole full of water)          | 181                 | 776             |
| Slate, white                            | 10                  | 786             |
| Lime                                    | 30                  | 816             |
| Sand                                    | 15                  | 831             |
| Slate                                   | 10                  | 841             |
| Lime                                    | 25                  | 866             |
| Sand, dark                              | 25                  | 891             |
| Slate, white                            | 8                   | 899             |
| Sand                                    | 5                   | 904             |
| Slate, white                            | 6                   | 910             |
| Red rock                                | 20                  | 930             |
| Lime                                    | 12                  | 942             |
| Slate, white                            | 6                   | 948             |
| Red rock                                | 6                   | 954             |
| Lime                                    | 6                   | 960             |
| Red rock                                | 12                  | 972             |
| Slate                                   | 7                   | 979             |
| Lime                                    | 8                   | 987             |
| Slate                                   | 6                   | 993             |
| Red rock                                | 10                  | 1003            |
| Slate                                   | 10                  | 1013            |

|   | Thickness. | Total.             |
|---|------------|--------------------|
|   | Feet.      | Feet.              |
| Big Lime .....  | 81         | 1094               |
| Sand, (Keener) .....  | 12         | 1106               |
| Red rock .....  | 6          | 1112               |
| Big Injun sand, hard and white (1st gas at 1169';<br>second gas at 1205') ..... | 93         | 1205               |
| Slate .....   | 7          | 1212               |
| Big Injun sand (volume of gas very small) .....                                 | 136        | 1248               |
| Lime .....  | 52         | 1300               |
| Sand, (Squaw) .....   | 20         | 1320               |
| Slate .....   | 100        | 1420               |
| Lime .....  | 75         | 1495               |
| Slate .....   | 20         | 1515               |
| Lime .....  | 55         | 1570               |
| Slate shells .....  | 30         | 1600               |
| Lime .....  | 64         | 1664               |
| Slate .....   | 12         | 1676               |
| Slate .....   | 18         | 1694               |
| Sand, (Gantz) .....   | 30         | 1724               |
| Slate .....   | 6          | 1730               |
| Lime .....  | 21         | 1751               |
| Sand, (Fifty-foot) .....  | 14         | 1765               |
| Slate .....   | 79         | 1844               |
| Slate and shells .....  | 28         | 1872               |
| Lime .....  | 10         | 1882               |
| Red rock .....  | 5          | 1887               |
| Slate .....   | 8          | 1895               |
| Red rock .....  | 12         | 1907               |
| Slate and shells .....  | 30         | 1937               |
| Red rock .....  | 6          | 1943               |
| Lime .....  | 10         | 1953               |
| Red rock and lime .....   | 168        | 2121               |
| Sand, (Fifth) .....   | 47         | 2168               |
| Slate .....   | 19         | 2187               |
| Sand .....  | 55'        | } (Bayard) 68 2255 |
| Slate .....   | 5          |                    |
| Sand .....  | 8          |                    |
| Slate to bottom, Aug. 15, 1912 .....  | 25.5       | 2280.5             |

10" casing, 319'6"; 8½" casing, 788'6"; 6½" casing, 1053'8".

"Volume of gas not sufficient for commercial purposes. All casing pulled, and hole plugged with wooden plug."

Mr. South estimates the volume of gas struck in the Big Injun at 20,000 cu. ft. daily.

Two miles southwestward along the strike of the strata, Hon. D. H. Courtney just recently completed a well on the north bank of the Monongahela, opposite Mona (Granville), the log of which as furnished the Survey with some slight changes and additions in parentheses is as follows:

### Joseph and David Krepps No. 1 Well Record (320A).

Morgan district, 1.5 miles northwest of Morgantown. Authority, Globe Fuel Co.

| (Elevation, 808' L-A.T.)                | Thickness. | Total. |
|---|------------|--------|
|   | Feet.      | Feet.  |
| Conductor .....                         | 40         | 40     |
| Lime .....                              | 20         | 60     |
| Sand and lime (water, 62') .....        | 55         | 115    |
| White slate .....                       | 35         | 150    |
| Coal, (Brush Creek) .....               | 5          | 155    |
| White slate .....                       | 49         | 204    |
| Red rock (?) .....                      | 10         | 214    |
| Coal, (Upper Freeport) .....            | 5          | 219    |
| Slate and shells (water, 285') .....    | 66         | 285    |
| White slate .....                       | 55         | 340    |
| Black sand .....                        | 45         | 385    |
| Slate and shells .....                  | 82         | 467    |
| White sand, (Salt) .....                | 40         | 507    |
| Slate .....                             | 9          | 516    |
| Coal, (Quakertown) .....                | 5          | 521    |
| Salt sand .....                         | 161        | 682    |
| Black slate .....                       | 30         | 712    |
| Slate and lime shells .....             | 113        | 825    |
| Red rock .....                          | 25         | 850    |
| White slate .....                       | 25         | 875    |
| Little Lime .....                       | 20         | 895    |
| Red rock .....                          | 22         | 917    |
| Big Lime .....                          | 90         | 1007   |
| Red rock .....                          | 5          | 1012   |
| Big Injun sand (small gas, 1075') ..... | 120        | 1132   |
| Lime .....                              | 90         | 1222   |
| White sand, (Squaw) .....               | 130        | 1352   |
| Slate, lime and sand shells .....       | 133        | 1485   |
| Slate and shells .....                  | 45         | 1530   |
| Dark lime .....                         | 40         | 1570   |
| Fifty-foot sand .....                   | 70         | 1640   |
| Red rock and shells .....               | 180        | 1820   |
| Sand (Fourth) (little gas 1822') .....  | 8          | 1828   |
| Red rock and shells .....               | 122        | 1950   |
| White slate .....                       | 55         | 2005   |
| Shells and sand .....                   | 20         | 2125   |
| White sand (Bayard) .....               | 15         | 2140   |
| White slate to bottom .....             | 111        | 2251   |

10" casing, 260'; 8¼" casing, 553'; 6¾" casing, 880'.

The above well starts, according to Reger, 64 feet by hand-level below the Ames limestone and 149 feet below the Elk Lick coal, or approximately 400 feet below the Pittsburgh coal horizon.

The following is the log of a well completed during 1884 on the north bank of Decker's creek in Morgantown, 0.4 mile east of the crest of the Indiana anticline:

## Snyder No. 1 Well Record (332).

Morgan district, at Morgantown. Completed in 1884.

|  | Thickness. | Total.                       |
|--|------------|------------------------------|
| (Elevation, 808' L-A. T.)  | Feet.      | Feet.                        |
| Conductor .....  | 7          | 7                            |
| Hard gray sandstone, (Big Dunkard).....  | 75         | 82                           |
| Shales, sandy.....   | 15         | 97                           |
| Coal, Brush Creek?.....  | 3          | 100                          |
| Shale and sandstone.....   | 40         | 140                          |
| Coal, Upper Freeport.....  | 4          | 144                          |
| Shales and very hard sandstone.....  | 76         | 220                          |
| Coal, (Upper Kittanning).....  | 4          | 224                          |
| Shales and sandstone.....  | 100        | 324                          |
| Coarse, gray sandstone.....  | 20         | 344                          |
| Blue shales.....   | 20         | 364                          |
| Hard white sandstone (II Cow Run and Salt) (much water<br>and some gas down to 540 feet, the last big water<br>strike) ..... | 200        | 564                          |
| Sandstone, hard, micaceous, white.....   | 36         | 600                          |
| Sandy beds, greenish gray.....   | 100        | 700                          |
| Shales, red, and green sandy beds.....   | 120        | 820                          |
| Limestone .....  | 10         | 830                          |
| Shales, red .....  | 20         | 850                          |
| Limestone, (Big Lime) .....  | 60         | 910                          |
| Red sand and shales .....  | 10         | } (Big Injun) ..... 310 1220 |
| Hard fine sand and limy beds .....   | 88         |                              |
| Blue sandy shales .....  | 100        |                              |
| Hard fine sand with some gaal12 }  |            |                              |
| Blue shales .....  | 150        | 1370                         |
| Dark, pebbly sand (gas, 1375 ) (Berea) .....   | 5          | 1375                         |
| Shells and hard fine sand (more gas) .....   | 108'6"     | 1483'6"                      |
| Gray sandy beds.....   | 171'6"     | 1655                         |
| Red shale and greenish gray shale .....  | 130        | 1785                         |
| Mostly red shale, and thin greenish gray shale .....   | 170        | 1955                         |
| Gray and red rock, and gray slate to bottom .....  | 312'6"     | 2267'6"                      |

The above well is reported to have made 10,000 to 12,000 cu. ft. of gas daily from the pay at 1375 feet, but it was never utilized.

The Ed Wells lot well (332A), located near the City Hospital in Morgantown, was drilled for water to a depth of 800 feet. It starts about 225 feet below the Pittsburgh coal horizon, so that it lacked about 375 feet of reaching the top of the Big Injun sand. No oil or gas in paying quantity was encountered.

During 1910 Jas. Kuntz, Jr. & Company of Washington, Pa., drilled a dry hole to a depth of approximately 3,000 feet below the Pittsburgh coal on Aaron creek in the southwest edge of Morgan district along the very steep western flank of

the Chestnut Ridge anticline. The following record of this well, kindly furnished by Hon. E. M. Grant of Morgantown, shows the sands very much broken and shelly and much red rock. The boring starts a few feet below the Upper Freeport coal, or approximately 600 feet below the horizon of the Pittsburgh bed:

### Edmund Shisler No. 1 Well Record (340).

Morgan district, 3.1 miles east of Uffington. Authority, James Kuntz, Jr., & Company. Completed June 4, 1910.

|                          | Thickness<br>Feet. | Total<br>Feet.               |
|--------------------------|--------------------|------------------------------|
| Ground (soil) .....      | 6                  | 6                            |
| Gravel .....             | 3                  | 9                            |
| Slate and shells .....   | 7                  | 16                           |
| Shell .....              | 4                  | 20                           |
| Lime and sand .....      | 60                 | 80                           |
| Slate .....              | 50                 | 130                          |
| Lime .....               | 22                 | 152                          |
| Slate .....              | 18                 | 170                          |
| Sand .....               | 40                 | 210                          |
| Coal, (Clarion) .....    | 3                  | 213                          |
| Slate .....              | 14                 | 227                          |
| Sand, (II Cow Run) ..... | 20                 | 247                          |
| Slate .....              | 25                 | 272                          |
| Shells .....             | 13                 | 285                          |
| Lime and sand .....      | 25                 | 310                          |
| Slate and shells .....   | 15                 | 325                          |
| Sand and shells .....    | 10                 | 335                          |
| Slate and shells .....   | 15                 | 350                          |
| Slate .....              | 25                 | 375                          |
| Red rock .....           | 70                 | 445                          |
| Shells .....             | 20                 | 465                          |
| Sand .....               | 15                 | 480                          |
| Slate and lime .....     | 40                 | 520                          |
| Salt sand .....          | 40                 | 560                          |
| Red rock and lime .....  | 75                 | 635                          |
| Lime and sand .....      | 15                 | 650                          |
| Slate and lime .....     | 40                 | 690                          |
| Red rock and lime .....  | 90                 | 780                          |
| Lime and sand .....      | 15'                | } (Greenbrier Limestone) 110 |
| Red rock .....           | 30                 |                              |
| Lime and sand .....      | 65                 |                              |
| Slate and shells .....   | 130'               | } (Big Injun) .....          |
| Sand .....               | 125                |                              |
| Lime and slate .....     | 155                | 1300                         |
| Sand .....               | 25                 | 1325                         |
| Slate and shells .....   | 75                 | 1400                         |
| Lime and sand .....      | 30                 | 1430                         |
| Sand .....               | 40                 | 1470                         |
| Slate .....              | 65                 | 1535                         |
| Sand and slate .....     | 50                 | 1585                         |

|   | Thickness. | Total. |
|---|------------|--------|
|   | Feet.      | Feet.  |
| Lime and sand .....   | 40         | 1625   |
| Slate and red rock .....  | 165        | 1790   |
| Shells and red rock .....   | 120        | 1910   |
| Sand and slate .....  | 55         | 1965   |
| Red rock and slate to bottom .....  | 435        | 2400   |
| "Result, Dry hole; sands broken and inferior from Injun down.<br>10" casing, 194'; 8½" casing, 482'; 6½" casing, 1167'. All casing<br>pulled; hole plugged to protect sands." |            |        |

If the above log is correct the Mauch Chunk series is almost 400 feet thick, the greatest recorded in the three counties. A slight scum of oil and a strong stream of fresh water was encountered in the Big Injun, which flows out the top of the hole.

The **Hagedorn & Sons No. 1 well (338)**, located on Deckers creek at the southeast edge of Dellslow, was completed in 1863 according to Chas. Hagedorn of the latter place, who reports a strong flow of gas struck at a depth of 600 feet. Mr. T. M. Pixler of the same town says his father reported the well 700 to 800 feet deep, at which depth a strong flow of gas and salt water was encountered, blowing down the drilling apparatus. The well starts 950 to 1000 feet below the horizon of the Pittsburgh coal; hence, the gas pay was probably in the Big Injun sand, since this horizon is generally water bearing, while the sands below are not. A light flow of gas still comes from the well mouth. The gas was never utilized.

The **Maiden Spring Run well (339)**, located 1.5 miles southeast of Dellslow, at the mouth of Maiden Spring run of Deckers creek, was completed in 1863, according to Mr. Hagedorn above mentioned, who reports the well as having reached a depth of 700 to 800 feet, and in addition to a strong flow of salt water a slight flow of oil was encountered. As the well starts in the Big Lime (Greenbrier Limestone), it evidently stopped near the top of the Gordon sand.

**Prospective Oil and Gas Areas, Morgan District.**—As mentioned at the beginning of the discussion of Morgan district practically the same structural conditions prevail as in Union to the northeast, which taken in connection with the barren test wells therein do not hold out much hope that the oil and gas operator will ever open a very prolific pool of

either in the district. However, that territory immediately northeastward from the river at Morgantown along the axis of the Indiana anticline to the 1250-foot contour of the Pittsburgh coal as outlined on Map II, appears favorable for light gas wells in the Big Injun and Berea sands; and, in view of the Berea gas in the Snider well (332) at Morgantown and the fact that the latter sand is non-water bearing, that area lying immediately along the axis of the Connellsville syncline from Easton southwest to Deckers creek may hold a small pool of oil at this horizon. The Berea gas pay was so light in the Snider well that the writer does not specially recommend the territory. All the eastern portion of the district lies in the region of very steep dips with the sands broken and shelly as revealed by the Shisler well (340) the log of which is given on a preceding page, so that no paying wells need be expected in this portion of Morgan. A well 1000 to 1200 feet deep where the axis of the Chestnut Ridge anticline crosses Decker's creek would test all the sands below the Big Injun down to and including the Bayard, and such a boring might result in a paying gas well owing to the dome-like structure there, but the risk would be great, since fracturing is always prevalent with folds of the magnitude of this great arch.

### *Clinton District.*

Clinton district lies immediately southwest of Morgan district and east of the Monongahela river, and its area is traversed by the same structural folds with the same structural conditions prevailing as in Union and Morgan. The results of drilling operations for oil and gas therein have been equally unsatisfactory, since out of five wells drilled none has proved productive of either oil or gas in paying quantity.

The log of the **F. M. Johnson No. 1 well (341)**, located 0.5 mile southeast of Uffington and completed during 1900, is published in detail on pages 133-134 of Vol. I(A) of the State Survey reports. Only slight shows of oil or gas were found in any of the sands. The boring penetrated to a depth of 360 feet below the Bayard sand.

The following is the log of a very light Bayard sand gasser

in the extreme southwest edge of Clinton. The well starts 30 to 40 feet below the Brush Creek coal, or approximately 560 feet below the Pittsburgh coal horizon:

### Rose Watson No. 1907 Well Record (344).

Cinton district, 0.4 mile south of Smithtown. Authority, Philadelphia Company. Completed May 3, 1901.

| (Elevation, 970' B-A. T.)   | Thickness. Total. |       |
|---|-------------------|-------|
|   | Feet.             | Feet. |
| Unrecorded .....  | 227               | 227   |
| Coal, (Lower Kittanning) .....  | 5                 | 232   |
| Unrecorded .....  | 415               | 647   |
| Salt sand .....   | 40                | 687   |
| Unrecorded .....  | 218               | 905   |
| Big Injun sand .....  | 152               | 1057  |
| Unrecorded .....  | 393               | 1450  |
| Fifty-foot sand .....   | 90                | 1540  |
| Unrecorded .....  | 506               | 2046  |
| Sand, (Bayard) (very small gas, 2046') .....                                  | 3                 | 2049  |
| 10" casing, 101'; 8" casing, 520'; 6" casing, 1020'. Abandoned July 17, 1901. |                   |       |

During 1911 the **Wm. E. Watson No. 1 well (343)**, located 1.3 miles northwest of Whiteday (Smithtown) on the head of Bunner's run, was drilled to a depth of 2450 feet below the Pittsburgh coal, cropping in the hill above the well, without getting either oil or gas.

One mile northwest of Triune the Hope Natural Gas Company recently completed a dry hole (**342A**) on the **Minor Tennant farm**, the log of which was not obtained.

The **Furnace Tract No. 1 well (342)**, located 0.4 mile southeast of Clinton Furnace and completed in 1865, was drilled to a depth of only 300 feet, according to Mr. O. C. Johnson of the latter place. The well starts about 775 feet below the horizon of the Pittsburgh coal; hence, it lacked 300 to 350 feet of getting down to the top of the Big Injun sand. No oil or gas was encountered, but 5 to 7 feet of coal was reported at a depth of about 75 feet, representing the Upper Mercer bed.

**Prospective Oil and Gas Areas, Clinton District.**—In that portion of Clinton district, Monongalia, lying to the southeast of the 1600-foot contour of the Pittsburgh coal as outlined on Map II, the dip of the strata is so rapid and the folding so



intense that it is quite problematical whether any paying oil or gas pools will ever be opened. The axis of the great Chestnut Ridge arch falls quite rapidly southwestward from its intersection with the Morgan-Clinton district line to and beyond the Monongalia-Marion county line, and the territory along the crest of this anticline eastward from Halleck may possibly hold a gas pool, but, as mentioned heretofore, the probability of cracks and faulting—always associated with intense folding—may have long ago permitted the gas to escape into the air. However, in the western portion of Clinton, a structural terrace has been formed by the intersection of the Indiana anticline with the steep western slope of the Chestnut Ridge arch, as shown on Map II, by the wide divergence of the 1450 and 1600-foot contours of the Pittsburgh coal; hence, structural conditions are favorable for a paying oil and gas pool in the Big Injun and deeper sands in that portion of the district lying immediately west of Booth's creek, northwest of the 1575-foot contour of the Pittsburgh coal, north of an east and west line through Smithtown and east of the 1450-foot contour of the Pittsburgh coal, the whole covering an area of 8 to 10 square miles. A boring in the vicinity of Little Falls would test fairly well the included area.

### MARION COUNTY WELL RECORDS.

The accompanying table contains the abbreviated logs of 358 borings from Marion county as well as levels on most of the same, along with elevations and data on 88 other wells the records of which were not obtainable. As with the Monongalia county list, these wells have been selected on account of their wide distribution and in some instances for some special feature associated with the well. The borings are numbered from 345 to 689 and grouped as in the table for Monongalia, first by magisterial districts and then by oil and gas pools, the serial number in each instance corresponding to the number of the same well on Map II. For further particulars the reader is referred to the explanations directly following the Monongalia table, page 414. Under the column headed "Owner," the following abbreviations are used:

|                     |   |
|---------------------|---|
| Anchor .....        | Anchor Oil Company.                           |
| Brown & Co. ....    | Leonard Brown & Co.                           |
| Burt .....          | Burt Oil Company.                             |
| Carnegie .....      | Carnegie Natural Gas Company.                 |
| Chartiers .....     | Chartiers Oil Company.                        |
| Clark .....         | Clark Oil Company.                            |
| Clayton .....       | Clayton Oil Company.                          |
| Cons. Coal .....    | Consolidation Coal Company.                   |
| Consolidation ..... | Consolidation Oil Company.                    |
| Delmar .....        | Delmar Oil Company.                           |
| Excelsior .....     | Excelsior Oil & Gas Company.                  |
| Fairmont .....      | Fairmont Gas Company.                         |
| Fayette .....       | Fayette County Gas Company.                   |
| Fisher .....        | Fisher Oil Company.                           |
| Freehold .....      | Freehold Oil & Gas Company.                   |
| Georges Creek ..... | Georges Creek Coal & Iron<br>Company.         |
| Grant Dev .....     | Grant Development Company.                    |
| Hartman .....       | Hartman Oil Company.                          |
| Hog Lick .....      | Hog Lick Oil & Gas Company.                   |
| Hope .....          | Hope Natural Gas Company.                     |
| Hukill .....        | E. M. Hukill & Company.                       |
| Marsh .....         | Marsh Oil & Gas Company.                      |
| Miller & Co. ....   | Geo. E. Miller & Company.                     |
| Monongahela .....   | Monongahela Gas Company.                      |
| McCune .....        | McCune Oil Company.                           |
| National .....      | National Oil & Gas Company.                   |
| New Central .....   | New Central Coal Company.                     |
| Pgh.-Buffalo .....  | Pittsburgh-Buffalo Coal Company.              |
| Phila. ....         | Philadelphia Company.                         |
| South Penn .....    | South Penn Oil Company.                       |
| U. S. Oil .....     | United State Oil Company.                     |
| Venture .....       | Venture Oil Company.                          |
| West Va. ....       | The West Virginia Company.                    |
| W. Va. T. & E. .... | West Virginia Traction & Electric<br>Company. |
| Wheeling .....      | Wheeling Natural Gas Company.                 |

In the elevation column the letter "B" indicates that the elevation of the well mouth was determined with aneroid barometer checked with nearby U. S. G. Survey spirit level elevations; the letter "L," with spirit level, the same being expressed in feet above tide. Depths to the Pittsburgh coal and the several sands are also expressed in feet. For the abbreviations under column headed "Producing Sand and Remarks," the reader is referred to page immediately following the Monongalia table of wells.

## Summarized Record of

| Map No. | NAME OF WELL                  | Location—District  | OWNER                 | Elevation A. T. |
|---------|-------------------------------|--------------------|-----------------------|-----------------|
| 345     | N. M. Glover .....            | Mannington .....   | Hope .....            | 1305B           |
| 346     | Jemima Metz .....             | Mannington .....   | Carnegie .....        | 1410B           |
| 347     | Dorcas (T.J.) Ash No. 2 ..... | Mannington .....   | South Penn .....      | 1100B           |
| 348     | L. A. Keenan No. 1 .....      | Mannington .....   | South Penn .....      | 1135B           |
| 349     | Rebecca Glover No. 1 .....    | Mannington .....   | Cochran & Funk .....  | 1460B           |
| 350     | R. M. Stewart No. 1 .....     | Mannington .....   | Barras et al. ....    | 1165B           |
| 351     | John Glover No. 1 .....       | Mannington .....   | Fisher .....          | 1460B           |
| 352     | C. W. Murphy No. 1 .....      | Mannington .....   | Hope .....            | 1150B           |
| 353     | A. M. Glover No. 2 .....      | Mannington .....   | Venture .....         | 1154L           |
| 354     | A. M. Glover No. 4 .....      | Mannington .....   | Venture .....         | 1160E           |
| 355     | A. M. Glover No. 3 .....      | Mannington .....   | Venture .....         | 1070B           |
| 356     | Solomon Glover No. 1 .....    | Mannington .....   | Carnegie .....        | 1610B           |
| 357     | W. F. Smith No. 2418 .....    | (Wetzel Co.) ..... | Phila .....           | 1200B           |
| 358     | J. L. Murray No. 1 .....      | Mannington .....   | Hope .....            | 1155B           |
| 359     | Geo. T. Hamilton No. 1 .....  | Mannington .....   | Carnegie .....        | 1235B           |
| 360     | J. L. Hamilton No. 1 .....    | Mannington .....   | Hope .....            | 1085B           |
| 361     | Geo. W. Hamilton No. 1 .....  | Mannington .....   | Carnegie .....        | .....           |
| 362     | Calvin Hamilton No. 1 .....   | Mannington .....   | Carnegie .....        | 1235B           |
| 363     | Jacob Myers No. 1 .....       | Mannington .....   | South Penn .....      | 1371L           |
| 364     | James Toothman No. 1 .....    | Mannington .....   | Hope .....            | 1355B           |
| 365     | Furbee Heirs No. 3 .....      | Grant .....        | Carnegie .....        | 1440B           |
| 366     | John Snodgrass No. 1 .....    | (Wetzel Co.) ..... | F. Bartlett .....     | 1197B           |
| 367     | John Ott No. 1 .....          | Mannington .....   | South Penn .....      | 1160L           |
| 368     | Wm. Devore No. 2 .....        | Mannington .....   | South Penn .....      | 1395B           |
| 369     | E. Batson No. 2 .....         | Grant .....        | South Penn .....      | 1290B           |
| 370     | J. T. Satterfield No. 2 ..... | (Wetzel Co.) ..... | Snyder & Pence .....  | 1195B           |
| 371     | Riley Arnett No. 2 .....      | Mannington .....   | Snyder & Pence .....  | 1120B           |
| 372     | Riley Arnett No. 1 .....      | Mannington .....   | South Penn .....      | 1055B           |
| 373     | Joseph Hayhurst No. 4 .....   | Mannington .....   | South Penn .....      | 1065B           |
| 374     | Joseph Hayhurst No. 1 .....   | Mannington .....   | South Penn .....      | 1028L           |
| 375     | Rachel Evans No. 1 .....      | Mannington .....   | Hartman .....         | 1170B           |
| 376     | Enoch Evans No. 3 .....       | Mannington .....   | Clayton .....         | 1040B           |
| 377     | Geo. Watson No. 1 .....       | Mannington .....   | South Penn .....      | 1110B           |
| 378     | Jacob L. Murray No. 1 .....   | Mannington .....   | South Penn .....      | 1040B           |
| 379     | Nancy L. Murray No. 1 .....   | Mannington .....   | Hope .....            | 1080B           |
| 380     | M. M. Kendall No. 135 .....   | Mannington .....   | Hope .....            | 1070B           |
| 881     | Henry Straight No. 1 .....    | Mannington .....   | Kirkland et al. ....  | 1125B           |
| 382     | Wm. Straight No. 1 .....      | Mannington .....   | Kirkland et al. ....  | 1170B           |
| 383     | John W. Batson No. 1 .....    | Mannington .....   | South Penn .....      | 1295B           |
| 384     | John Baker No. 4 .....        | Mannington .....   | South Penn .....      | .....           |
| 385     | J. L. Hayes No. 1 .....       | Mannington .....   | T. N. Barnsdale ..... | 1160B           |
| 386     | Jas Hawkinberry No. 1 .....   | Mannington .....   | South Penn .....      | 1125B           |
| 387     | Henry Baker No. 1 .....       | Mannington .....   | Fisher .....          | 1050B           |
| 388     | B. Wells No. 1 .....          | Mannington .....   | Burt .....            | 1045B           |
| 389     | Benj. Dodd No. 3 .....        | Mannington .....   | South Penn .....      | 1255B           |

## Wells in Marion County.

| PITTSBURGH COAL |           | Big Injun Sand (top) | Thirty Foot Sand (top) | Gordon Sand (top) | Fourth Sand (top) | Fifth Sand (top) | Total Depth | PRODUCING SAND AND REMARKS                 | Map No. |
|-----------------|-----------|----------------------|------------------------|-------------------|-------------------|------------------|-------------|--|---------|
| Depth (top)     | Thickness |                      |                        |                   |                   |                  |             |  |         |
| 1018            |           | 2303                 |                        |                   |                   |                  | 2460        | B. I. gas.....                             | 345     |
| 918             | 7         | 2196                 | 2933                   | 3064              |                   |                  | 3077        | Max., B. I., 50-ft. gas;<br>Gord. oil..... | 346     |
| 969             | 7         | 2240                 | 2978                   | 3108              | 3152              | 3209             | 3240        | Max. gas, 30-ft. oil....                   | 348     |
| 1280            | 8         | 2585                 | 3294                   |                   |                   |                  | 3315        | 30-ft. oil.....                            | 349     |
| 1280            | 10        | 2585                 | 3301                   |                   |                   |                  | 3320        | 30-ft. oil.....                            | 350     |
| 960             | 6         | 2246                 | 2986                   |                   |                   |                  | 3001        | B. I. gas.....                             | 351     |
| 952             | 6         | 2250                 | 2985                   |                   |                   |                  | 3001        | 30-ft. oil.....                            | 352     |
| 857             | 6         | 2163                 | 2884                   |                   |                   |                  | 2903        | B. I. gas, 30-ft. oil....                  | 353     |
| 1380            | 6         | 2676                 |                        | 3562              | 3628              |                  | 3723        | 30-ft. oil.....                            | 354     |
| 982             |           | 2253                 |                        | 3082              | 3160              |                  | 3333        | Dry hole.....                              | 355     |
| 935             |           | 2229                 |                        | 3083              |                   |                  | 3257        | B. I. gas, Gord. & 4th oil.                | 356     |
| 1000            | 8         | 2270                 |                        |                   |                   |                  | 2355        | Gordon gas.....                            | 357     |
| 965             |           | 2260                 |                        |                   |                   |                  | 3138        | B. I. gas.....                             | 359     |
| 1160            |           | 2440                 |                        | 3322              |                   |                  | 3356        | Gord. gas show.....                        | 360     |
| 990             | 8         | 2272                 |                        | 3074              | 3147              |                  | 3177        | B. I. & 4th gas, Max. oil.                 | 361     |
| 1060            |           |                      |                        |                   |                   |                  | 2197        | B. I., Gord. & 4th gas...                  | 362     |
|                 |           |                      |                        |                   |                   |                  |             | Max. gas.....                              | 363     |
|                 |           |                      |                        |                   |                   |                  |             |  | 364     |
|                 |           |                      |                        |                   |                   |                  |             |  | 365     |
| 907             | 8         | 2198                 |                        |                   |                   |                  | 2325        | B. I. oil.....                             | 366     |
| 1180            | 7         | 2466                 |                        |                   |                   |                  | 2538        | B. I. oil.....                             | 367     |
| 1045            | 8         | 2343                 |                        |                   |                   |                  | 2445        | B. I. oil.....                             | 368     |
| 952             | 5         | 2225                 | 2941                   |                   | 3126              |                  | 3220        | B. I. gas and oil.....                     | 369     |
| 872             | 13        | 2148                 |                        |                   | 3085              |                  | 3297        | Max. oil; Stray gas.....                   | 370     |
| 880             |           | 2080                 |                        |                   |                   |                  | 2071        | B. I. gas; 4th oil.....                    | 371     |
| 844             | 11        | 2143                 |                        | 2993              |                   |                  | 3088        | Max. oil.....                              | 372     |
| 1005            |           | 2305                 |                        |                   |                   |                  | 3345½       | Salt, 50-ft. gas; Max.,<br>Gord. oil.....  | 373     |
| 863             | 7         | 2183                 | 2880                   | 3018              |                   |                  | 3088        | Dry hole.....                              | 374     |
| 833             | 5         | 2155                 |                        |                   |                   |                  | 2328        | Max. oil.....                              | 375     |
| 870             |           | 2180                 |                        |                   |                   |                  | 2880        | Stray gas; Gord. oil show                  | 376     |
| 776             |           | 2080                 |                        | 2925              |                   |                  | 3008        | Dry hole.....                              | 377     |
|                 |           |                      |                        |                   |                   |                  |             | 50-ft. gas.....                            | 378     |
|                 |           |                      |                        |                   |                   |                  |             | Gord. oil.....                             | 379     |
|                 |           |                      |                        |                   |                   |                  |             | B. I. oil.....                             | 380     |
| 1078            | 11        | 2399                 |                        |                   |                   |                  | 2523        | Dry hole.....                              | 381     |
| 1256            | 7         | 2566                 |                        |                   |                   |                  | 2675        | B. I. oil.....                             | 382     |
|                 |           |                      |                        |                   |                   |                  |             | B. I. gas and oil.....                     | 383     |
|                 |           |                      |                        |                   |                   |                  |             | B. I. oil.....                             | 384     |
|                 |           |                      |                        |                   |                   |                  |             |  | 385     |
| 860             | 12        | 2174                 |                        | 3050              |                   |                  | 3162        | B. I. oil; Gord. gas.....                  | 386     |
|                 |           |                      |                        |                   |                   |                  |             | Dry hole.....                              | 387     |
| 800             |           | 2105                 | 2835                   |                   |                   |                  | 2859        | 30-ft. oil.....                            | 388     |
| 1008            | 12        | 2318                 |                        |                   |                   |                  | 2448        | Gas sand gas & B. I. oil.                  | 389     |

## Summarized Record of

| Map No. | NAME OF WELL                | Location—<br>District | OWNER             | Location<br>A. T. |
|---------|-----------------------------|-----------------------|-------------------|-------------------|
| 390     | Benj. Dodd No. 2            | Mannington            | South Penn        | 1060B             |
| 391     | Jacob Baker No. 1 (?)       | Mannington            | Burt              | 1095B             |
| 392     | Sarah L. Kendall No. 1      | Mannington            | Hartless & Barris | 1035B             |
| 393     | August Sturm No. 2          | Mannington            | Freehold          | 1070B             |
| 394     | Snodgrass Bros. No. 3       | Mannington            | Freehold          | 1055B             |
| 395     | M. W. Sturm No. 2           | Mannington            | South Penn        | .....             |
| 396     | Lusetta Snodgrass No. 1     | Mannington            | South Penn        | .....             |
| 397     | Farrell Heirs No. 2         | Mannington            | Hartman           | 1190B             |
| 398     | Aaron Furbee No. 1          | Mannington            | South Penn        | 1018L             |
| 399     | Farrell Heirs No. 4         | Mannington            | Hartman           | 1185B             |
| 400     | Barnes & Fleming No. 2 (?)  | Mannington            | South Penn        | 1320B             |
| 401     | Farrell Heirs No. 3         | Mannington            | Hartman           | 1015B             |
| 402     | Lemley & Hibbs No. 1        | Mannington            | Hartman           | 1125B             |
| 403     | T. P. Freeland No. 1        | Mannington            | South Penn        | 1015B             |
| 404     | Wm. Robey No. 1             | Mannington            | West Virginia     | 1005B             |
| 405     | T. P. Freeland No. 1        | Mannington            | Monongahela       | 1010B             |
| 406     | Wm. Metz (Z. Tennant) No. 1 | Mannington            | Taylor            | 1010L             |
| 407     | John W. Brummage No. 1      | Mannington            | .....             | .....             |
| 408     | Scott Arnett No. 1          | Mannington            | South Penn        | 1247L             |
| 409     | John Styles No. 1           | Mannington            | South Penn        | 1060B             |
| 410     | E. Moore Heirs No. 1        | Mannington            | South Penn        | .....             |
| 411     | I. E. Arnett No. 2          | Mannington            | South Penn        | .....             |
| 412     | E. Moore Heirs No. 2        | Mannington            | South Penn        | 1060B             |
| 413     | Joseph Campbell No. 1       | Mannington            | South Penn        | 1090B             |
| 414     | Isaac Campbell No. 3        | Mannington            | South Penn        | 1100B             |
| 415     | I. E. Arnett No. 1          | Mannington            | South Penn        | 1074L             |
| 416     | Elizabeth Thomas No. 1      | Mannington            | South Penn        | 1086L             |
| 417     | Samuel Moore No. 1          | Mannington            | South Penn        | 1115B             |
| 418     | Simon Moore No. 1           | Mannington            | South Penn        | 1135B             |
| 419     | Jas. Fox No. 1              | Mannington            | South Penn        | 1190B             |
| 420     | Isaac Campbell No. 2        | Mannington            | South Penn        | .....             |
| 421     | Isaac Campbell No. 5        | Mannington            | South Penn        | .....             |
| 422     | Guy Arnett No. 1            | Mannington            | Wheeling          | .....             |
| 423     | I. F. Thomas No. 1          | Mannington            | South Penn        | 1075B             |
| 424     | Asbury Moore No. 1          | Mannington            | South Penn        | 1495B             |
| 425     | John Grubb No. 2            | Mannington            | South Penn        | 1109L             |
| 426     | Sanford Toothman No. 1      | Mannington            | South Penn        | .....             |
| 427     | W. R. Dickens No. 1         | Mannington            | .....             | 1065B             |
| 428     | Mike Snyder No. 2           | Mannington            | South Penn        | 1174L             |
| 429     | J. A. Thomas No. 1          | Mannington            | South Penn        | 1021L             |
| 430     | Absalom Holbert No. 1       | Mannington            | Burt              | 1030B             |
| 431     | Ash Fluharty No. 1          | Mannington            | South Penn        | 1000L             |
| 432     | E. J. Freeland No. 1        | Mannington            | South Penn        | .....             |
| 433     | C. W. Bayles No. 1          | Mannington            | South Penn        | 1000B             |
| 434     | Francis Mason No. 1         | Mannington            | Story et al       | 975B              |
| 435     | C. W. Bayles No. 2          | Mannington            | South Penn        | 1030B             |
| 436     | Catherine Tennant (No. 3?)  | Mannington            | South Penn        | 1000B             |
| 437     | Frank O. Price No. 1        | Mannington            | South Penn        | 1050B             |
| 438     | Isaac Hibbs No. 2           | Mannington            | .....             | 1085B             |
| 439     | Isaac Hibbs No. 1           | Mannington            | .....             | 1070B             |



## Summarized Record of

| Map No. | NAME OF WELL                   | Location—<br>District | OWNER              | Elevation<br>A T |
|---------|--------------------------------|-----------------------|--------------------|------------------|
| 440     | S. C. Hibbs No. 1 .....        | Mannington .....      | Hayes et al. ....  | 1105B            |
| 441     | Bert Haines .....              | Mannington .....      | Hayes & Koen ..... | 1160B            |
| 442     | M. A. Prichard Heirs No. 1 ..  | Mannington .....      | South Penn .....   | 1150B            |
| 443     | Isaac Efaw No. 5 .....         | Mannington .....      | Carnahan .....     | 1420B            |
| 444     | C. S. Pitzer No. 2 .....       | Mannington .....      | South Penn .....   | 1450B            |
| 445     | Isaac Efaw No. 1 .....         | Mannington .....      | Carnahan .....     | 1115B            |
| 446     | C. S. Pitzer No. 1 .....       | Mannington .....      | South Penn .....   | 1320B            |
| 447     | J. L. Beaty No. 1 .....        | Mannington .....      | South Penn .....   | 1130B            |
| 448     | A. J. Hayes No. 8 .....        | Mannington .....      | Delmar .....       | 1300B            |
| 449     | Benj. Grubb No. 3 .....        | Mannington .....      | Freehold .....     | 1080B            |
| 450     | A. J. Hayes No. 15 .....       | Mannington .....      | Delmar .....       | 1060B            |
| 451     | B. B. Board No. 1 .....        | Mannington .....      | Freehold .....     | 1010B            |
| 452     | B. B. Board No. 2 .....        | Mannington .....      | Freehold .....     | 1010B            |
| 453     | A. J. Hayes No. 13 .....       | Mannington .....      | Delmar .....       | 1025B            |
| 454     | Joseph McGill No. 1 .....      | Mannington .....      | Wheeling .....     | 995B             |
| 455     | A. F. Hamilton .....           | Mannington .....      | Koen & Beaty ..... | 1014L            |
| 456     | Fred Beaty No. 1 .....         | Mannington .....      | Beaty et al. ....  | 1080B            |
| 457     | George Beaty No. 3 .....       | Mannington .....      | Anchor .....       | 995B             |
| 458     | George Beaty No. 1 .....       | Mannington .....      | Anchor .....       | 1000B            |
| 459     | Jas. Hayes No. 1 .....         | Mannington .....      | Hope .....         | 1175B            |
| 460     | Jonathan Arnett No. 1 .....    | Mannington .....      | Carnegie .....     | 1055B            |
| 461     | Perry Arnett No. 1 .....       | Mannington .....      | Carnegie .....     | 1100B            |
| 462     | W. N. Cunningham No. 4 .....   | Mannington .....      | South Penn .....   | 1075B            |
| 463     | W. N. Cunningham No. 1 .....   | Mannington .....      | South Penn .....   | 1071L            |
| 464     | Jacob Cunningham No. 9 .....   | Mannington .....      | South Penn .....   | 1070B            |
| 465     | Jacob Cunningham No. 3 .....   | Mannington .....      | South Penn .....   | 1155B            |
| 466     | Jacob Brummage No. 1 .....     | Mannington .....      | South Penn .....   | 1370B            |
|         |                                | Grant .....           |                    |                  |
| 467     | Cephus Higgins No. 2 .....     | (Wetzel Co.) ..       | South Penn .....   | 1215B            |
| 468     | S. J. Gump No. 1 .....         | Mannington .....      | Hope .....         | 1030B            |
| 469     | Alexander Huey No. 1 .....     | Mannington .....      | Delmar .....       | .....            |
| 470     | Newton Huey .....              | Mannington .....      | Huey et al. ....   | 1085B            |
| 471     | M. W. Huey Heirs No. 1 .....   | Mannington .....      | South Penn .....   | 1320B            |
| 472     | J. A. Harbert No. 1 .....      | Mannington .....      | South Penn .....   | 1085B            |
| 472A    | George A. Huey No. 1 .....     | Mannington .....      | South Penn .....   | 1350B            |
| 473     | A. J. Ice, Sr., No. 1 .....    | Mannington .....      | Delmar .....       | 1100B            |
| 474     | Daniel F. Heldreth No. 1 ..... | Mannington .....      | Chartiers .....    | 1145B            |
| 475     | Jesse Talkington No. 1 .....   | Mannington .....      | Delmar .....       | 1085B            |
| 476     | Ellis Shriver .....            | Mannington .....      | Clark .....        | .....            |
| 477     | Isabel Moore No. 1 .....       | Mannington .....      | Clark .....        | 1075B            |
| 478     | A. H. Heldreth No. 1 .....     | Mannington .....      | Delmar .....       | 1050B            |
| 479     | Serepta Cunningham No. 1 ..    | Mannington .....      | South Penn .....   | 1055B            |
| 480     | P. C. McDonald No. 3 .....     | Mannington .....      | Delmar .....       | 1085B            |
| 481     | W. T. Ice No. 8 .....          | Mannington .....      | Delmar .....       | 1090B            |
| 482     | Joshua Looman No. 1 .....      | Mannington .....      | Delmar .....       | .....            |
| 483     | B. F. Robinson No. 4 .....     | Mannington .....      | Delmar .....       | .....            |

## Wells in Marion County—Continued.

| PITTSBURGH COAL |           | Big Injun Sand (top) | Thirty Foot Sand (top) | Gordon Sand (top) | Fourth Sand (top) | Fifth Sand (top) | Total Depth | PRODUCING SAND AND REMARKS                                     | Map No. |
|-----------------|-----------|----------------------|------------------------|-------------------|-------------------|------------------|-------------|--|---------|
| Depth (top)     | Thickness |                      |                        |                   |                   |                  |             |  |         |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | Gord. oil show.....  | 440     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | .....  | 441     |
| 744             | .....     | 1804                 | .....                  | 2674              | .....             | .....            | 2704        | B. I. oil show; 4th oil...                                     | 442     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | 30-ft. oil.....  | 443     |
| 1120            | .....     | 2445                 | 3162                   | .....             | .....             | .....            | 3187        | 50-ft. gas; 30-ft. oil....                                     | 444     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | 30-ft. oil.....  | 445     |
| 982             | 8         | 2292                 | 3023                   | .....             | .....             | .....            | 3052        | 30-ft. oil.....  | 446     |
| 774             | 10        | 2108                 | 2805                   | 2933              | 3042              | .....            | 3111        | 30-ft. oil & Salt Gord. gas                                    | 447     |
| 1007            | 9         | 2343                 | 3020                   | .....             | .....             | .....            | 3037        | 30-ft. oil.....  | 448     |
| 790             | .....     | 2105                 | 2800                   | .....             | .....             | .....            | 2823        | 30-ft. oil.....  | 449     |
| 768             | .....     | 2098                 | 2775                   | .....             | .....             | .....            | 2826        | 30-ft. oil.....  | 450     |
| 720             | 7         | .....                | 2724                   | 2850              | .....             | .....            | .....       | 30-ft. oil; Gord. gas show                                     | 451     |
| .....           | .....     | .....                | 2718                   | .....             | .....             | .....            | 2736        | 30-ft. oil.....  | 452     |
| 710             | 8         | 2040                 | 2720                   | 2838              | .....             | .....            | 2870        | 30-ft. oil; Gord. gas.....                                     | 453     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | .....  | 454     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | .....  | 455     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | .....  | 456     |
| 645             | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | Gord. gas.....   | 457     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | 30-ft. oil.....  | 458     |
| 921             | .....     | 2223                 | .....                  | 3079              | .....             | .....            | 3130        | B. I., Gordon gas.....   | 459     |
| 818             | .....     | 2145                 | .....                  | 2928              | 2966              | .....            | 2998        | Gord. and 4th gas.....   | 460     |
| 893             | .....     | 2187                 | .....                  | 3035              | .....             | .....            | 3049        | .....  | 461     |
| 915             | 8         | 2238                 | .....                  | 2990              | .....             | .....            | 3013        | Gord. oil.....   | 462     |
| 904             | 6         | 2211                 | 2930                   | 3042              | .....             | .....            | 3189        | 30-ft. and Gord. gas show;<br>Gord. and Stray oil<br>show..... | 463     |
| 895             | 7         | 2186                 | .....                  | 2992              | .....             | .....            | 3015        | Gord. oil.....   | 464     |
| 1035            | .....     | 2328                 | .....                  | 3117              | .....             | .....            | 3138        | Gord. oil.....   | 465     |
| 1225            | 5         | 2525                 | .....                  | .....             | .....             | .....            | 3339        | Gord. oil.....   | 466     |
| 1064            | 6         | 2350                 | .....                  | 3165              | .....             | .....            | 3202        | Gord. oil.....   | 467     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | Dry hole.....  | 468     |
| 815             | 6         | 2182                 | 2860                   | 2972              | .....             | .....            | 3317        | Max. oil; 50-ft. gas.....                                      | 469     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | Dry hole.....  | 470     |
| 955             | 10        | 2274                 | 2950                   | 3101              | .....             | .....            | 3122        | B. I. gas; 30-ft. & Gord.<br>oil.....                          | 471     |
| 734             | 5         | .....                | .....                  | .....             | .....             | .....            | 1943½       | Maxton oil.....  | 472     |
| 972             | 5         | 2300                 | 2976                   | 3121              | .....             | .....            | 3146        | Gord. oil, 30-ft. oil show                                     | 472A    |
| 837             | 4         | 2176                 | .....                  | .....             | .....             | .....            | 2975        | 50-ft. & Stray gas.....  | 473     |
| 940             | .....     | 2222                 | .....                  | 3051              | .....             | .....            | 3742½       | B. I. & Gord. oil show..                                       | 474     |
| 823             | 9         | 2109                 | .....                  | 2938              | .....             | .....            | 3324        | Gord. oil and gas,<br>50-ft. gas.....                          | 475     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | 30-ft. oil.....  | 476     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | 30-ft. oil.....  | 477     |
| 660             | 9         | .....                | .....                  | .....             | .....             | .....            | 1607        | Moundsville gas.....   | 478     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | .....  | 479     |
| 843             | 8         | 2135                 | .....                  | 2950              | .....             | .....            | 2997        | Gordon oil.....  | 480     |
| 935             | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | .....  | 481     |
| 1053            | 10        | 2326                 | .....                  | 3130              | .....             | .....            | 3164        | B. I. gas; Gord. oil.....                                      | 482     |
| 1225            | 6         | 2501                 | 3200                   | 3311              | .....             | .....            | 3375        | 50-ft. oil and gas.....  | 483     |



## Summarized Record of

| Map No. | NAME OF WELL             | Location—<br>District | OWNER          | Elevation<br>A. T. |
|---------|--------------------------|-----------------------|----------------|--------------------|
| 484     | Mary E. Price No. 1      | Mannington            | Delmar         | 1209B              |
| 485     | B. F. Robinson No. 1     | Mannington            | Delmar         | 1155B              |
| 486     | A. J. Ice, Jr., No. 1    | Mannington            | Delmar         | 1135B              |
| 487     | Daniel Varner No. 1      | Mannington            | Burt           | 1155B              |
| 488     | F. M. Fluharty No. 1     | Mannington            | Burt           | 1150B              |
| 489     | Columbus Snodgrass No. 1 | Mannington            | Burt           | 990B               |
| 490     | Thornton Fluharty No. 1  | Mannington            | Burt           | 1055B              |
| 491     | Alfred F. Sine No. 3     | Mannington            | Greenlee & Co. | 980L               |
| 492     | M. A. Morgan No. 2       | Mannington            | Hartman        | 985B               |
| 493     | Nimrod Morgan No. 7      | Mannington            | Hartman        | 984B               |
| 494     | Nimrod Morgan No. 5      | Mannington            | Hartman        | 977B               |
| 495     | Paddy Hopkins No. 2      | Mannington            | Burt           | 972B               |
| 496     | Paddy Hopkins No. 1      | Mannington            | Burt           | 976B               |
| 497     | George Furbee No. 1      | Mannington            | Marsh          | 981L               |
| 498     | James Fluharty No. 1     | Mannington            | South Penn     | 1305B              |
| 499     | E. Wilson No. 1          | Mannington            | South Penn     | 1180B              |
| 500     | C. A. Kuhn No. 1         | Mannington            | South Penn     | 1195B              |
| 501     | Ozias Kuhn No. 1         | Mannington            | South Penn     | .....              |
| 502     | B. F. Blackshere No. 15  | Mannington            | South Penn     | 1250B              |
| 503     | Watson Heirs No. 1       | Mannington            | South Penn     | 1090B              |
| 504     | Francis Snodgrass No. 1  | Mannington            | South Penn     | 1225B              |
| 505     | F. H. Burt No. 15        | Mannington            | Burt           | 1000B              |
| 506     | F. H. Burt No. 1         | Mannington            | Burt           | 962L               |
| 507     | F. H. Burt No. 16        | Mannington            | Burt           | 1087L              |
| 508     | F. H. Burt No. 14        | Mannington            | Burt           | 1057L              |
| 509     | F. H. Burt No. 6         | Mannington            | Burt           | 970L               |
| 510     | Erwin-Prichard No. 1     | Mannington            | South Penn     | 1020B              |
| 511     | N. S. Beaty No. 1        | Mannington            | South Penn     | 985B               |
| 512     | G. M. Floyd No. 1        | Mannington            | South Penn     | 1000B              |
| 513     | R. P. Floyd No. 1        | Mannington            | U. S. Oil      | 1135B              |
| 514     | Jefferson Holbert No. 1  | Mannington            | South Penn     | 1490B              |
| 515     | J. W. Conaway No. 3      | Mannington            | South Penn     | 1064B              |
| 516     | Michael Kennedy No. 1    | Mannington            | South Penn     | 1090B              |
| 517     | John Kennedy No. 2       | Mannington            | South Penn     | 1120B              |
| 518     | Koen & Pritchard No. 1   | Mannington            | Hartman        | 1380B              |
| 519     | J. C. Straight No. 2     | Mannington            | South Penn     | 1140B              |
| 520     | Z. Kendall No. 3         | Mannington            | Hartman        | 1370B              |
| 521     | Z. Kendall No. 2         | Mannington            | Hartman        | 1380B              |
| 522     | Z. Kendall No. 1         | Mannington            | Hartman        | 1385B              |
| 523     | S. M. Tetrick No. 2      | Mannington            | Hartman        | 1475B              |
| 524     | S. M. Tetrick No. 1      | Mannington            | Hartman        | 1425B              |
| 525     | Martha B. Shafer No. 2   | Mannington            | Chartiers      | 1275B              |
| 526     | Henry Tetrick No. 5      | Mannington            | Hope           | 1160B              |
| 527     | Wm. Wright No. 1         | Mannington            | South Penn     | 1270B              |
| 528     | L. J. Hall No. 1         | Mannington            | —              | 1225B              |
| 529     | P. G. Hall No. 3         | Mannington            | —              | 1160B              |
| 530     | P. Gaughan No. 1         | Mannington            | South Penn     | .....              |
| 531     | John N. Hall No. 1       | Mannington            | South Penn     | 1155B              |

## Wells in Marion County—Continued.

| PITTSBURGH COAL |           | Big Injan Sand (top) | Thirty Foot Sand (top) | Gordon Sand (top) | Fourth Sand (top) | Fifth Sand (top) | Total Depth | PRODUCING SAND AND REMARKS           | Map No. |
|-----------------|-----------|----------------------|------------------------|-------------------|-------------------|------------------|-------------|--------------------------------------|---------|
| Depth (top)     | Thickness |                      |                        |                   |                   |                  |             |                                      |         |
| 1105            | 6         | 2395                 | .....                  | 3186              | .....             | .....            | 3210        | Stray oil and gas .....              | 484     |
| 1002            | 8         | .....                | .....                  | 3117              | .....             | .....            | 3158        | Gord. oil .....                      | 485     |
| 1020            | .....     | 2310                 | .....                  | 3105              | .....             | .....            | 3143        | Stray & Gord. oil .....              | 486     |
| 710             | .....     | .....                | .....                  | .....             | .....             | .....            | 2170        | B. I. oil; B. Lime gas ..            | 487     |
| 735             | 7         | 2040                 | .....                  | 2925              | 2978              | .....            | 3002        | Gordon gas .....                     | 488     |
| 608             | 9         | 1921                 | .....                  | 2843              | 2857              | .....            | 2937        | B. Dunk gas. ....                    | 489     |
| 575             | 5         | 1914                 | .....                  | 2796              | 2825              | .....            | 3035        | 50-ft. gas .....                     | 490     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | .....                                | 491     |
| 505             | .....     | 1956                 | .....                  | .....             | 2727              | .....            | 2736        | .....                                | 492     |
| 482             | .....     | 1775                 | .....                  | 2645              | 2699              | .....            | 2714        | B. I. gas; 4th oil .....             | 493     |
| 462             | .....     | 1780                 | .....                  | .....             | 2681              | .....            | .....       | 4th oil .....                        | 494     |
| 463             | .....     | .....                | .....                  | .....             | 2678              | .....            | .....       | 4th oil .....                        | 495     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | 4th oil and Gnz. & 50-ft. gas .....  | 496     |
| 464             | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | B. I. & Squaw gas .....              | 497     |
| 441             | 11        | 1755                 | .....                  | .....             | .....             | .....            | .....       | B. I. oil .....                      | 498     |
| 818             | .....     | 2155                 | .....                  | .....             | .....             | .....            | 2254        | Gnz. and 4th gas .....               | 499     |
| 696             | 6         | 2040                 | .....                  | .....             | 2924              | .....            | 2973        | 4th gas .....                        | 500     |
| 696             | .....     | 2017                 | .....                  | 2918              | 2952              | .....            | 3132        | B. I., 50-ft., 4th gas...            | 501     |
| 668             | 7         | 1980                 | .....                  | .....             | 2896              | .....            | 2924        | B. I. gas and oil .....              | 502     |
| 632             | 7         | 1990                 | .....                  | .....             | .....             | .....            | 2125        | B. I. oil .....                      | 503     |
| 484             | .....     | 1843                 | .....                  | .....             | .....             | .....            | 1949        | .....                                | 504     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | .....                                | 505     |
| 445             | .....     | 1788                 | .....                  | .....             | .....             | .....            | 1896        | B. Dunk. gas; B. I. oil ..           | 506     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | B. I. oil .....                      | 507     |
| 328             | 10        | 1872                 | .....                  | .....             | .....             | .....            | 1975        | B. I. & 4th oil .....                | 508     |
| 510             | .....     | 1838                 | .....                  | 2723              | .....             | .....            | 3000        | B. I. oil .....                      | 509     |
| 415             | .....     | 1755½                | .....                  | 2660              | 2694              | .....            | 1849½       | 4th oil .....                        | 510     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | 2741        | .....                                | 511     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | .....                                | 512     |
| 497             | .....     | 1845                 | .....                  | 2705              | .....             | .....            | 2740        | 4th oil; 50-ft. gas .....            | 513     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | 50-ft. gas; 4th oil .....            | 514     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | 3228        | 4th oil, very large .....            | 515     |
| 508             | 6         | 1835                 | .....                  | .....             | 2710              | .....            | 2715        | Gnz. gas, 4th oil .....              | 516     |
| 551             | 10        | 1908                 | .....                  | .....             | 2751              | .....            | 2764        | 4th oil, large well .....            | 517     |
| 590             | 10        | 1924                 | .....                  | .....             | 2780              | .....            | 2788        | B. I. gas & oil; 4th oil ..          | 518     |
| 795             | .....     | 2162                 | .....                  | .....             | .....             | .....            | 2254        | B. I. oil .....                      | 519     |
| 552             | 10        | 1900                 | .....                  | .....             | 2758              | 2816             | 3042        | B. I. gas show; 4th oil ..           | 520     |
| 779             | 8         | 2145                 | .....                  | .....             | .....             | .....            | 2255        | B. I. oil .....                      | 521     |
| 785             | .....     | 2157                 | .....                  | .....             | .....             | .....            | 2245        | B. I. oil .....                      | 522     |
| 782             | .....     | 2161                 | .....                  | .....             | .....             | .....            | 2304        | B. I. oil .....                      | 523     |
| 878             | .....     | 2244                 | .....                  | .....             | .....             | .....            | 2336        | B. I. oil .....                      | 524     |
| 817             | .....     | 2194                 | .....                  | .....             | .....             | .....            | 2295        | B. I. oil .....                      | 525     |
| 737             | .....     | .....                | .....                  | .....             | 2935              | .....            | 2955        | 4th oil .....                        | 526     |
| 570             | .....     | 1900                 | .....                  | 2759              | 2806              | .....            | 2826        | Gord. gas .....                      | 527     |
| 740             | 8         | 2054                 | .....                  | .....             | 2910              | .....            | 2938        | 50-ft. gas, 4th oil, large.          | 528     |
| .....           | .....     | 2000                 | .....                  | 2873              | 2900              | 2950             | 3012        | B. I. oil show, Gnz. gas.            | 529     |
| 603             | 9         | 1943                 | .....                  | 2758              | 2779              | .....            | 2807        | B. I. & 4th oil, 50-ft. gas.         | 530     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | B. I., Gnz. & 30-ft. gas shows ..... | 531     |
| 584             | 8         | 1900                 | 2625                   | .....             | .....             | .....            | 2857        | B. I. oil .....                      | 531     |

## Summarized Record of

| Map No. | NAME OF WEL                        | Location—<br>District | OWNER                  | Elevation<br>A. T. |
|---------|------------------------------------|-----------------------|------------------------|--------------------|
| 532     | Koen Bros. No. 1 .....             | Mannington ...        | Huey et al. ....       | 1130B              |
| 533     | S. E. Snyder No. 1 .....           | Mannington ...        | South Penn .....       | 1030B              |
| 534     | E. C. Morgan No. 1 .....           | Mannington ...        | South Penn .....       | 1455B              |
| 535     | Abram Ashcraft No. 1 .....         | Mannington ...        | South Penn .....       | 1230B              |
| 536     | Lindsay Blaker No. 1 .....         | Mannington ...        | South Penn .....       | 1115B              |
| 537     | Lindsay Blaker No. 2 .....         | Mannington ...        | South Penn .....       | 1100B              |
| 538     | W. P. Mason No. 1 .....            | Mannington ...        | South Penn .....       | 1013L              |
| 539     | W. P. Mason core test .....        | Mannington ...        | J. V. Thompson .....   | 1005L              |
| 540     | Daniel Mason No. 1 .....           | Mannington ...        | South Penn .....       | 1025B              |
| 541     | Fleming Hamilton No. 1 .....       | Mannington ...        | A. J. Montgomery ..... | 1055B              |
| 542     | G. R. Morgan No. 1 .....           | Mannington ...        | South Penn .....       | 1060B              |
| 543     | M. S. Snodderly No. 1 .....        | Mannington ...        | South Penn .....       | 1205B              |
| 544     | Chas. Hibbs No. 1 .....            | Mannington ...        | South Penn .....       | .....              |
| 545     | R. J. Martin No. 1 .....           | Mannington ...        | Phila .....            | 1080B              |
| 546     | G. L. Fortney No. 1 .....          | Mannington ...        | Hope .....             | 1115B              |
| 547     | Dudley Robinson No. 1 .....        | Mannington ...        | Carnegie .....         | 1135B              |
| 548     | John Mason No. 1 .....             | (Harrison Co.)        | South Penn .....       | 1010B              |
| 549     | H. L. Jones No. 1 .....            | Mannington ...        | Hope .....             | 1530L              |
| 550     | J. A. Wadsworth No. 1 .....        | Mannington ...        | Phila .....            | 1125B              |
| 551     | Noah Price No. 1 .....             | Pawpaw .....          | South Penn .....       | 1600B              |
| 552     | Jos. Michael No. 1 .....           | Pawpaw .....          | South Penn .....       | 1300B              |
| 553     | P. B. Amos No. 11 .....            | Pawpaw .....          | Fisher .....           | 1105B              |
| 554     | David Jones No. 1 .....            | Pawpaw .....          | South Penn .....       | 1018L              |
| 555     | Brice Wallace No. 1 .....          | Pawpaw .....          | South Penn .....       | 1135B              |
| 556     | David Jones No. 5 .....            | Pawpaw .....          | South Penn .....       | .....              |
| 557     | G. W. Toothman No. 5 .....         | Pawpaw .....          | South Penn .....       | .....              |
| 558     | G. W. Toothman No. 1 .....         | Pawpaw .....          | South Penn .....       | 1035B              |
| 559     | Jas. Yost No. 8 .....              | Pawpaw .....          | South Penn .....       | 1030B              |
| 559A    | H. S. Baanett No. 1 .....          | Pawpaw .....          | Phila .....            | 1040B              |
| 560     | P. W. Yost No. 1 .....             | Pawpaw .....          | Ira DeWitt .....       | 1030B              |
| 561     | Mary Burns No. 2 .....             | Pawpaw .....          | Consolidation .....    | 1005B              |
| 562     | L. N. Yost No. 5 .....             | Pawpaw .....          | Consolidation .....    | 1010B              |
| 563     | J. G. Eddy No. 1 .....             | Pawpaw .....          | South Penn .....       | 1075B              |
| 564     | Alice (Kuhn) Lamberton No. 1 ..... | Pawpaw .....          | Carnegie .....         | 1140B              |
| 565     | Silas Wilson Heirs No. 1 .....     | Pawpaw .....          | Fairmont .....         | 1220B              |
| 566     | G. W. Brown No. 1 .....            | Pawpaw .....          | Fisher .....           | 1185B              |
| 567     | Jas. Eddy No. 1 .....              | Pawpaw .....          | Hope .....             | 1280B              |
| 568     | Jeff. Wilson No. 1 .....           | Pawpaw .....          | Fairmont .....         | 1060B              |
| 569     | Jas. Eddy No. 1 .....              | Pawpaw .....          | Carnegie .....         | 1065B              |
| 570     | Jacob A. Mason No. 1 .....         | Pawpaw .....          | Carnegie .....         | 1148L              |
| 571     | A. T. Hibbs No. 1 .....            | Pawpaw .....          | Hope .....             | 1020B              |
| 572     | W. R. Toothman No. 1 .....         | Pawpaw .....          | Carnegie .....         | 1215B              |
| 573     | J. E. Michael No. 1 .....          | Pawpaw .....          | Hope .....             | 1040B              |
| 574     | W. G. King No. 1791 .....          | Pawpaw .....          | Hope .....             | 972L               |
| 575     | H. C. B. Hall No. 1 .....          | Pawpaw .....          | Wheeling .....         | 1120B              |
| 576     | A. S. Kennedy No. 1 .....          | Pawpaw .....          | Benedum & Trees .....  | 1010B              |
| 577     | Ulyses M. Price No. 1 .....        | Pawpaw .....          | Hope .....             | .....              |
| 578     | Jonathan Eddy No. 1 .....          | Pawpaw .....          | Hope .....             | 1050B              |
| 579     | John H. Ammons coal test .....     | Pawpaw .....          | .....                  | 980B               |



## Summarized Record of

| Map No. | NAME OF WELL                               | Location—<br>District | OWNER               | Elevation<br>A. T. |
|---------|--|-----------------------|---------------------|--------------------|
| 580     | Frank Arnett No. 1 .....                   | Pawpaw                | Hukill .....        | 1020B              |
| 581     | Alpheus (J. L.) Fluharty No. 1             | Pawpaw                | Hope .....          | 1030B              |
| 582     | H. B. Amos No. 1 .....                     | Pawpaw                | Wheeling .....      | 1123B              |
| 583     | D. L. Toothman No. 1 .....                 | Pawpaw                | Hope .....          | 1185B              |
| 584     | Jas. Brand No. 1 .....                     | Pawpaw                | Hope .....          | 1205B              |
| 585     | J. W. Williams No. 1 .....                 | Pawpaw                | W. Va. T. & E. .... | 1199L              |
| 586     | O. L. Smith et al. No. 1 .....             | Pawpaw                | W. Va. T. & E. .... | 1200B              |
| 587     | Wm. R. Clayton No. 1 .....                 | Pawpaw                | Clayton .....       | 925B               |
| 588     | New Central Coal Co. No. 3.                | Pawpaw                | New Central .....   | 910B               |
| 589     | Wm. Wallace No. 2 .....                    | Lincoln               | Hope .....          | 1210B              |
| 590     | M. V. Millan No. 1 .....                   | Lincoln               | Phila .....         | 1155B              |
| 591     | Wm. Wallace No. 1 .....                    | Lincoln               | Hope .....          | 1110B              |
| 592     | W. M. Billingslea No. 1 .....              | Lincoln               | South Penn .....    | 1095B              |
| 593     | J. A. Holbert No. 1 .....                  | Lincoln               | South Penn .....    | 1055B              |
| 594     | Benj. Huffman No. 3 .....                  | Lincoln               | South Penn .....    | 1075B              |
| 595     | Eli T. Price No. 1 .....                   | Lincoln               | South Penn .....    | .....              |
| 596     | A. O. Talkington No. 2 .....               | Lincoln               | South Penn .....    | 1155B              |
| 597     | A. O. Talkington No. 7 .....               | Lincoln               | South Penn .....    | 1105B              |
| 598     | A. O. Talkington No. 1 .....               | Lincoln               | South Penn .....    | 1135L              |
| 599     | Rezin Amos No. 1 .....                     | Lincoln               | Jackson et al. .... | 1117L              |
| 600     | L. D. Martin No. 1 .....                   | Lincoln               | Fayette .....       | .....              |
| 601     | E. M. Parish No. 1 .....                   | Lincoln               | South Penn .....    | 1300B              |
| 602     | N. Beaty No. 20 .....                      | Lincoln               | McCune .....        | 1145B              |
| 603     | N. Beaty No. 17 .....                      | Lincoln               | McCune .....        | 1170B              |
| 604     | N. Beaty No. 10 .....                      | Lincoln               | McCune .....        | 1065B              |
| 605     | John Eagan No. 3 .....                     | Lincoln               | Brown & Co. ....    | 1310B              |
| 606     | Festus Downs No. 4 .....                   | Lincoln               | Brown & Co. ....    | 1100B              |
| 607     | F. (O. M.) Freeland No. 1 ..               | Lincoln               | Phila. ....         | 981L               |
| 608     | Albert Pyles .....                         | Lincoln               | Fairmont .....      | 1065B              |
| 609     | Miller Heirs .....                         | Lincoln               | Hope .....          | 1150B              |
| 610     | Hunter Atha No. 1 .....                    | Lincoln               | Fayette .....       | 1050B              |
| 611     | Sallie Martin coal test .....              | Lincoln               | Cons. coal .....    | 1010L              |
| 612     | Jack Connor No. 1 .....                    | Lincoln               | Fayette .....       | 1045B              |
| 612A    | I. M. Lough No. 1 .....                    | Lincoln               | Hope .....          | 1415B              |
| 613     | Wm. Barrackman No. 1 .....                 | Lincoln               | .....               | 1125B              |
| 614     | Geo. Price No. 4 .....                     | Lincoln               | .....               | 1025B              |
| 615     | E. W. Hamilton No. 1 .....                 | Lincoln               | Hope .....          | 1230B              |
| 616     | E. W. Hamilton No. 1 .....                 | Lincoln               | McCune .....        | 1060B              |
| 617     | Eliza Brand Heirs No. 1 .....              | Lincoln               | Hope .....          | 1115B              |
| 618     | Plum Run coal test .....                   | Lincoln               | .....               | .....              |
| 619     | Annie Cunningham No. 1 .....               | Lincoln               | Carnegie .....      | 1060B              |
| 620     | R. Martin No. 1 .....                      | Lincoln               | Carnegie .....      | 955B               |
| 621     | Morgan-Fox coal test No. 14..              | Lincoln               | Cons. coal .....    | 998L               |
| 622     | A. B. Morgan No. 1 .....                   | Lincoln               | Carnegie .....      | 1150B              |
| 623     | Jessie B. Martin coal test<br>No. 10 ..... | Lincoln               | Cons. coal .....    | 936L               |
| 624     | John W. Criss No. 1 .....                  | Lincoln               | Carnegie .....      | 975B               |
| 625     | E. T. Wood coal test No. 3 ..              | Lincoln               | Pgh.-Buffalo .....  | 974L               |
| 626     | H. L. Sturm No. 1 .....                    | Lincoln               | Hope .....          | 1115B              |

Wells in Marion County—Continued.

| PITTSBURGH COAL |           | Big Injun Sand (top) | Thirty Foot Sand (top) | Gorden Sand (top) | Fourth Sand (top) | Fifth Sand (top) | Total Depth | PRODUCING SAND AND REMARKS   | Map No. |
|-----------------|-----------|----------------------|------------------------|-------------------|-------------------|------------------|-------------|------------------------------|---------|
| Depth (top)     | Thickness |                      |                        |                   |                   |                  |             |                              |         |
| 338             | 8         | 1663                 | 2360                   | 2553              | .....             | 2682             | 3065        | B. I. gas .....              | 580     |
| 410             |           |                      |                        |                   |                   |                  |             |                              | 581     |
| 505             |           | 1842                 |                        | 2700              | 2786              | 2852             | 2854        | B. I. and 5th gas.....       | 582     |
|                 |           |                      |                        |                   |                   |                  |             |                              | 583     |
| 488             | 7         | 1856                 | 2524                   | 2707              | 2765              | 2871             | 3025        | B. I., Gnz. & "Gas" gas..    | 584     |
| 477             | 7         |                      |                        |                   |                   |                  |             | B. I. gas .....              | 585     |
|                 |           |                      |                        |                   |                   |                  | 40          | Arnoldsburg gas .....        | 586     |
|                 |           |                      |                        |                   |                   |                  | 125?        | Sewickley coal gas .....     | 587     |
| 747             |           | 2087                 |                        |                   | 2952              | 3017             | 3138        | B. I., 5th, 6th gas.....     | 588     |
| 640             |           | 1915                 |                        | 2830              | 2868              |                  | 2886        | 4th gas .....                | 589     |
| 590             | 11        | 1912                 |                        |                   |                   |                  |             |                              | 590     |
| 542             |           | 1850                 |                        |                   |                   |                  | 1975        | B. I. oil .....              | 591     |
| 512             |           | 1860                 |                        |                   |                   |                  | 1960        | B. I. oil .....              | 592     |
| 544             | 8         | 1887                 |                        |                   |                   |                  | 2010        | B. I. oil .....              | 593     |
| 860             | 10        | 2190                 |                        |                   |                   |                  | 2314        | B. I. oil .....              | 594     |
| 565             | 10        | 1910                 |                        |                   |                   |                  | 2040        | B. I. oil .....              | 595     |
| 510             |           | 1852                 |                        |                   |                   |                  | 1960        | B. I. oil .....              | 596     |
| 521             |           | 1857                 |                        |                   |                   |                  | 1994        | B. I. oil .....              | 597     |
| 510             | 7         | 1855                 |                        |                   |                   |                  | 1959        | B. I. oil .....              | 598     |
| 670             |           | 2005                 |                        |                   |                   |                  | 2160        | B. I. oil .....              | 599     |
| 715             | 7         | 2065                 |                        |                   |                   |                  | 2191        | B. I. oil .....              | 600     |
| 575             |           | 1905                 |                        |                   |                   |                  | 2032        | B. I. oil .....              | 601     |
| 600             |           |                      |                        |                   | 2850              |                  | 3060        | B. I. oil; 4th & 6th gas.    | 602     |
|                 |           |                      |                        |                   |                   |                  |             |                              | 603     |
| 715             |           |                      |                        |                   | 2947              |                  | 3136        | B. I. oil; 4th & 6th gas..   | 604     |
| 485             |           |                      |                        |                   | 2718              |                  | 2735        | B. I. & 4th oil.....         | 605     |
|                 |           |                      |                        |                   |                   |                  |             |                              | 606     |
| 354             |           |                      |                        |                   |                   | 2733             |             | 5th gas .....                | 607     |
| 465             |           | 1795                 |                        |                   | 2685              | 2840             | 2859        | B. I. & 5th gas .....        | 608     |
| 357             | 10        | 1718                 |                        |                   | 2560              | 2605             | 2750        | B. I. & Bayard gas.....      | 609     |
|                 |           |                      |                        |                   |                   |                  |             |                              | 610     |
| 368             |           | 1710                 |                        |                   | 2575              |                  | 2757        | Bayard gas .....             | 611     |
| 768             |           | 2115                 |                        |                   | 3008              | 3150             | 3184        | B. I. & 5th gas.....         | 612     |
|                 |           |                      |                        |                   |                   |                  |             |                              | 612A    |
|                 |           |                      |                        |                   |                   |                  |             |                              | 613     |
|                 |           |                      |                        |                   |                   |                  |             |                              | 614     |
| 600             |           | 1937                 |                        |                   | 2835              |                  | 3025        | B. I., 50-ft., 4th & 6th gas | 615     |
|                 |           |                      |                        |                   |                   |                  |             |                              | 616     |
| 475             |           | 1816                 |                        | 2688              | 2717              |                  | 2882        | B. I. gas .....              | 617     |
|                 |           |                      |                        |                   |                   |                  |             |                              | 618     |
|                 |           |                      |                        |                   |                   |                  |             |                              | 619     |
|                 |           |                      |                        |                   |                   |                  |             |                              | 620     |
| 324             | 8'2"      |                      |                        |                   |                   |                  | 332½        |                              | 621     |
| 470             | 9'        | 1844                 | 2556                   | 2690              | 2735              | 2856             | 2916        | 5th gas .....                | 622     |
|                 |           |                      |                        |                   |                   |                  |             |                              | 623     |
| 234             | 10        |                      |                        |                   |                   |                  | 245½        |                              | 624     |
| 275             | 9         | 1656                 |                        | 2479              | 2573              | 2695             | 2714        | 5th gas .....                | 625     |
| 288             | 8'2"      |                      |                        |                   |                   |                  | 296¼        |                              | 626     |
| 435             |           | 1830                 |                        | 2645              | 2710              | 2838             | 2856        | 5th gas .....                | 626     |

## Summarized Record of

| Map No. | NAME OF WELL                                      | Location—<br>District | OWNER               | Elevation<br>A. T. |
|---------|---|-----------------------|---------------------|--------------------|
| 627     | Jas. Morgan (Silas Stark)<br>No. 1894 .....       | Lincoln .....         | Phila .....         | 1112L              |
| 628     | D. C. Jones No. 2449 .....                        | Mannington .....      | Phila. ....         | 1245B              |
| 629     | H. R. Glover No. 1885 .....                       | Mannington .....      | Phila. ....         | 1210B              |
| 629A    | I. N. Ashcraft coal test .....                    | Mannington .....      | Pgh.-Buffalo .....  | .....              |
| 630     | M. M. Martin No. 2121 .....                       | Lincoln .....         | Phila. ....         | 1045B              |
| 631     | Joshua Hess No. 1 .....                           | Lincoln .....         | Hope .....          | 1240B              |
| 632     | J. N. (Nancy) Cunningham<br>No. 1889. ....        | Lincoln .....         | Phila. ....         | 997L               |
| 532A    | J. N. Cunningham coal test .....                  | Lincoln .....         | Pgh.-Buffalo .....  | .....              |
| 633     | L. H. Tetrick No. 1 .....                         | Lincoln .....         | Hope .....          | 1290B              |
| 634     | Margarette Parrish No. 923 .....                  | Lincoln .....         | Hope .....          | 1235B              |
| 634A    | Absalom Martin coal test No. 1 .....              | Lincoln .....         | Pgh.-Buffalo .....  | 1122L              |
| 635     | A. A. Parrish No. 805 .....                       | Lincoln .....         | Hope .....          | 1285B              |
| 636     | John E. Parrish No. 787 .....                     | Lincoln .....         | Hope .....          | 1150B              |
| 637     | E. T. Martin No. 1565 .....                       | Lincoln .....         | Hope .....          | 1135B              |
| 638     | W. S. Parrish coal test No. 11 .....              | Lincoln .....         | Cons. coal .....    | 1082L              |
| 639     | W. S. Parrish No. 2197 .....                      | Lincoln .....         | Hope .....          | 1240B              |
| 639A    | Olive Minnear coal test No. 2 .....               | Lincoln .....         | Pgh.-Buffalo .....  | 1007L              |
| 640     | A. Martin No. 2165 .....                          | Lincoln .....         | Hope .....          | 1155B              |
| 640A    | Jane Downs coal test No. 4 .....                  | Lincoln .....         | Pgh.-Buffalo .....  | 1064L              |
| 641     | Mattie C. Sturm No. 1 .....                       | Lincoln .....         | Phila. ....         | 1035B              |
| 641A    | B. D. Holbert coal test .....                     | Lincoln .....         | Pgh.-Buffalo .....  | .....              |
| 642     | E. H. Stevens No. 2138 .....                      | Lincoln .....         | Phila. ....         | 1033L              |
| 643     | Mary Hawkins coal test No. 13 .....               | Lincoln .....         | Cons. coal .....    | 946L               |
| 644     | Clement Davis No. 1 .....                         | Lincoln .....         | Carnegie .....      | 1143B              |
| 645     | L. L. Kuhn No. 1 .....                            | Lincoln .....         | Fayette .....       | 1050B              |
| 646     | Z. F. Davis coal test No. 4 .....                 | Lincoln .....         | Cons. coal .....    | 965L               |
| 647     | W. P. Fortney coal test No. 3 .....               | Lincoln .....         | Cons. coal .....    | 918L               |
| 648     | John N. Woods No. 1 .....                         | Lincoln .....         | Hope .....          | 1410B              |
| 649     | Felix Cunningham No. 2269 .....                   | Lincoln .....         | Phila. ....         | 1224B              |
| 650     | J. S. Billingslea No. 1 .....                     | Lincoln .....         | Phila. ....         | 1220B              |
| 651     | Marvin Tetrick (Eleon<br>Straight) No. 2148 ..... | Lincoln .....         | Phila. ....         | 1220B              |
| 652     | Nancy Billingsley coal test<br>No. 5 .....        | Lincoln .....         | Cons. coal .....    | 994L               |
| 653     | Wm. F. Sandy coal test No. 12 .....               | Lincoln .....         | Cons. coal .....    | 1101L              |
| 654     | J. L. Davis coal test .....                       | Lincoln .....         | Georges Creek ..... | 926B               |
| 655     | Curtis Fletcher coal test No. 9 .....             | Lincoln .....         | Cons. coal .....    | 918L               |
| 656     | Vanzandt Helrs No. 1 .....                        | Lincoln .....         | Phila. ....         | 950B               |
| 657     | May Downs No. 1 .....                             | Lincoln .....         | Phila. ....         | 1305B              |
| 658     | Geo. I. Ensminger No. 2343 .....                  | Lincoln .....         | Phila. ....         | 1125B              |
| 659     | Nancy Martin coal test No. 6 .....                | Lincoln .....         | Cons. coal .....    | 998L               |
| 660     | J. L. Jones coal test No. 2 .....                 | Lincoln .....         | Cons. coal .....    | 1202L              |
| 661     | Curtis Davis No. 1 .....                          | Lincoln .....         | Carnegie .....      | 1240B              |
| 662     | W. C. Kuhn No. 1 .....                            | Lincoln .....         | Hope .....          | 1170B              |
| 663     | E. C. Morgan coal test No. 1 .....                | Lincoln .....         | Cons. coal .....    | .....              |
| 664     | Eli M. Rex No. 1 .....                            | Fairmont .....        | Hope .....          | 1070B              |
| 665     | Lewis Hall No. 1 .....                            | Fairmont .....        | Phila. ....         | 1065B              |
| 666     | A. Boulou No. 1 .....                             | Fairmont .....        | A. Bowen .....      | 950B               |

Wells in Marion County—Continued.

| PITTSBURGH COAL |           | Big Injun Sand (top) | Thirty Foot Sand (top) | Gordon Sand (top) | Fourth Sand (top) | Fifth Sand (top) | Total Depth | PRODUCING SAND AND REMARKS | Map No. |
|-----------------|-----------|----------------------|------------------------|-------------------|-------------------|------------------|-------------|----------------------------|---------|
| Depth (top)     | Thickness |                      |                        |                   |                   |                  |             |                            |         |
| 328             | .....     | 1680                 | .....                  | .....             | .....             | .....            | 1713        | B. I. gas .....            | 627     |
| 606             | 9'        | 1976                 | .....                  | .....             | .....             | .....            | 2077        | .....                      | 628     |
| 560             | 13        | .....                | .....                  | .....             | .....             | .....            | .....       | .....                      | 629     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | .....                      | 629A    |
| 300             | 5         | 1690                 | .....                  | .....             | 2512              | 2683             | 2687        | 4th oil & gas; 5th gas..   | 630     |
| 480             | .....     | 1866                 | .....                  | 2697              | 2722              | 2861             | 2917        | Gord., 5th gas .....       | 631     |
| 179             | 10        | .....                | .....                  | .....             | .....             | .....            | .....       | .....                      | 632     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | .....                      | 632A    |
| 375             | .....     | 1797                 | .....                  | 2610              | 2655              | 2790             | 3200        | 5th gas .....              | 633     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | .....                      | 634     |
| 437             | 7         | .....                | .....                  | .....             | .....             | .....            | .....       | .....                      | 634A    |
| 600             | 8         | 1971                 | .....                  | 2836              | 2875              | 2993             | 3055        | B. I. & 30-ft. gas .....   | 635     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | .....                      | 636     |
| 435             | .....     | 1822                 | .....                  | 2597              | 2696              | 2808             | 2830        | 5th gas .....              | 637     |
| 389             | 9'9"      | .....                | .....                  | .....             | .....             | .....            | 400         | .....                      | 638     |
| 570             | 7'        | 1965                 | 2565                   | 2767              | 2805              | 2957             | 3032        | 50-ft. and 5th gas.....    | 639     |
| 268             | 7         | .....                | .....                  | .....             | .....             | .....            | .....       | .....                      | 639A    |
| 400             | 7         | 1788                 | 2428                   | 2587              | 2627              | 2790             | 2692        | B. I. & 5th gas .....      | 640     |
| 329             | 8         | .....                | .....                  | .....             | .....             | .....            | .....       | .....                      | 640A    |
| 175             | .....     | 1580                 | .....                  | 2382              | 2412              | 2575             | 2613        | 5th gas .....              | 641     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | .....                      | 641A    |
| 190             | 4         | 1630                 | .....                  | 2410              | .....             | 2590             | 2613        | 5th gas .....              | 642     |
| 65              | 8'11½"    | .....                | .....                  | .....             | .....             | .....            | 77          | .....                      | 643     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | .....                      | 644     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | .....                      | 645     |
| 198             | 9'5"      | .....                | .....                  | .....             | .....             | .....            | 208         | .....                      | 646     |
| 183             | 9'1½"     | .....                | .....                  | .....             | .....             | .....            | 192½        | .....                      | 647     |
| 620             | .....     | 2025                 | .....                  | 2810              | 2895              | 2986             | 3006        | 5th gas .....              | 648     |
| 500             | .....     | 1900                 | .....                  | 2715              | .....             | 2866             | 2910        | 5th gas .....              | 649     |
| 477             | .....     | 1865                 | .....                  | .....             | 2824              | 2848             | 2908        | 4th and 5th gas .....      | 650     |
| 460             | .....     | 1863                 | .....                  | 2690              | .....             | 2845             | 2881        | 5th gas .....              | 651     |
| 197             | 9'10"     | .....                | .....                  | .....             | .....             | .....            | 208½        | .....                      | 652     |
| 272             | 10'6"     | .....                | .....                  | .....             | .....             | .....            | 283½        | .....                      | 653     |
| 228             | 9'        | .....                | .....                  | .....             | .....             | .....            | 237         | .....                      | 654     |
| 198             | 9'6"      | .....                | .....                  | .....             | .....             | .....            | 209½        | .....                      | 655     |
| 255             | .....     | 1576                 | .....                  | 2485              | 2540              | 2643             | 2862        | B. I. & 5th gas.....       | 656     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | .....                      | 657     |
| 390             | .....     | 1748                 | .....                  | 2655              | 2687              | 2767             | 2912        | B. I. & 5th gas .....      | 658     |
| 217             | 9'8½"     | .....                | .....                  | .....             | .....             | .....            | 228         | .....                      | 659     |
| 461             | 8'        | .....                | .....                  | .....             | .....             | .....            | 470½        | .....                      | 660     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | .....                      | 661     |
| .....           | .....     | 1697                 | .....                  | .....             | .....             | .....            | 1715        | B. I. gas .....            | 662     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | .....                      | 663     |
| 365             | 10        | 1735                 | 2455                   | 2550              | 2600              | 2655             | 2873        | Dry hole .....             | 664     |
| 417             | 9         | 1775                 | 2483                   | 2606              | 2667              | 2759             | 3027        | Dry hole .....             | 665     |
| 235             | 8         | 1658                 | .....                  | 2377              | .....             | 2600             | .....       | .....                      | 666     |



## Summarized Record of

| Map No. | NAME OF WELL                             | Location - District | OWNER                | Stratum A. T. |
|---------|--|---------------------|----------------------|---------------|
| 667     | John Gollohue No. 1 .....                | Fairmont .....      | Hukill .....         | 915B          |
| 668     | Conoway, Hamilton & Erwin No. 1 .....    | Fairmont .....      | Carnegie .....       | 940B          |
| 669     | Morgan-Billingslee coal test No. 8 ..... | Fairmont .....      | Cons. coal .....     | 914L          |
| 670     | Wm. Straight No. 1 .....                 | Fairmont .....      | Thos. Miller ? ..... | 930B          |
| 671     | Andrew Ice No. 1 .....                   | Fairmont .....      | Thos. Miller ? ..... | 885B          |
| 672     | Shore coal test No. 7 .....              | Fairmont .....      | Cons. coal .....     | 984L          |
| 673     | Millard Boggess No. 1 .....              | Fairmont .....      | Phila. ....          | 940B          |
| 673A    | Andrew Riggs No. 1 .....                 | Fairmont .....      | Phila. ....          | 955B          |
| 674     | Wm. Watson No. 1 .....                   | Grant .....         | J. M. Guffey .....   | 885B          |
| 675     | Doyle (Louanna) Everson No. 1 .....      | Grant .....         | Phila. ....          | 993B          |
| 676     | Presley Ogden No. 1 .....                | Grant .....         | Phila. ....          | 919L          |
| 677     | John Wright No. 1 .....                  | Grant .....         | National .....       | 945L          |
| 678     | J. Lee Bice No. 1 .....                  | Grant .....         | Hog Lick .....       | 1020B         |
| 679     | Frank Boice No. 1 .....                  | Grant .....         | Hope .....           | 950B          |
| 680     | Harriet Frum No. 1 .....                 | Grant .....         | Grant Dev. ....      | 995B          |
| 681     | Davis Heirs No. 1 .....                  | Grant .....         | Fitch et al. ....    | 1156L         |
| 682     | F. M. Meredith No. 1 .....               | Winfield .....      | Miller & Co. ....    | 1100B         |
| 682A    | Brent S. Jones No. 1 .....               | Winfield .....      | Hope .....           | 985B          |
| 683     | Vincent Heirs No. 2010 .....             | Winfield .....      | Hope .....           | 1114L         |
| 684     | John M. Turner No. 1 .....               | Winfield .....      | .....                | 1110B         |
| 684A    | Amos Huffman No. 1 .....                 | Winfield .....      | Hope .....           | .....         |
| 685     | Rogers & Lake No. 1 .....                | Union .....         | .....                | 1115B         |
| 685A    | Hiram Linn No. 1 .....                   | Union .....         | Excelsior .....      | .....         |
| 686     | Harris L. Jolliffe No. 1 .....           | Union .....         | Madera et al. ....   | 975B          |
| 687     | W. R. Jasper Heirs No. 1 .....           | Union .....         | McDonald et al. .... | 926L          |
| 688     | J. F. Vangilder No. 1 .....              | Union .....         | Miller & Co. ....    | 975B          |
| 688A    | Edwin Nuzum No. 2504 .....               | Union .....         | Hope .....           | .....         |

Wells in Marion County—Continued.

| PITTSBURGH COAL |           | Big Injun Sand (top) | Thirty Foot Sand (top) | Gorden Sand (top) | Fourth Sand (top) | Fifth Sand (top) | Total Depth | PRODUCING SAND AND REMARKS | Map No. |
|-----------------|-----------|----------------------|------------------------|-------------------|-------------------|------------------|-------------|----------------------------|---------|
| Depth (top)     | Thickness |                      |                        |                   |                   |                  |             |                            |         |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | .....                      | 667     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | .....                      | 668     |
| 218             | 9'11½"    | .....                | .....                  | .....             | .....             | .....            | 229½        | .....                      | 669     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | Dry hole                   | 670     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | Dry hole                   | 671     |
| 274             | 10'       | .....                | .....                  | .....             | .....             | .....            | .....       | .....                      | 672     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | .....                      | 673     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | B. I. & 5th gas            | 673A    |
| 5               | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | Dry hole                   | 674     |
| 28              | .....     | 1450                 | .....                  | .....             | .....             | 2395             | 2505        | B. I. & 6th gas            | 675     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | .....                      | 676     |
| 40              | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | .....                      | 677     |
| 0               | .....     | 1483                 | 2100                   | 2206              | .....             | 2392             | 2569        | B. I., 50-ft. & 6th gas    | 678     |
| .....           | .....     | 1380                 | .....                  | 2077              | .....             | 2280             | 2323        | B. I., 50-ft. gas          | 679     |
| .....           | .....     | 1367                 | .....                  | 2080              | .....             | 2323             | 2434        | Squaw oil                  | 680     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | Dry hole                   | 681     |
| .....           | .....     | 1410                 | .....                  | .....             | .....             | 2363             | 2490        | .....                      | 682     |
| .....           | .....     | 845                  | .....                  | 1595              | 1690              | 1775             | 2539        | .....                      | 682A    |
| .....           | .....     | 658                  | 1313                   | .....             | .....             | 1639             | 3400        | B. I. gas, light           | 683     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | Dry hole                   | 684     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | Dry hole                   | 684A    |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | 1200        | Gas show                   | 685     |
| .....           | .....     | 960                  | .....                  | .....             | .....             | .....            | 2019        | Speechley gas show         | 685A    |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | Dry hole                   | 686     |
| .....           | .....     | 1000                 | 1560                   | 1700              | .....             | .....            | 2347        | Dry hole                   | 687     |
| .....           | .....     | 1290                 | 1870                   | 2015              | .....             | 2269             | 2384        | B. I. oil show; 5th &      | 688     |
| .....           | .....     | .....                | .....                  | .....             | .....             | .....            | .....       | 6th gas                    | 688     |
| .....           | .....     | 992                  | .....                  | 1843              | 1909              | 2015             | 2926        | Dry hole                   | 688A    |

For the same reasons as given on the page immediately following the Monongalia table of wells, the complete records of a number of the borings in Marion will now be given and discussed. The serial number is published not only in the foregoing table, but along with the heading in parenthesis when the complete log is given, as well as on Map II.

### ***Mannington District.***

Mannington district occupies the western portion of Marion county and its entire area lies in the Robinson Basin, but by far the greater portion along the eastern flank of this trough. This district has produced more oil than all the remaining part of the county, the main producing sands being the Big Injun, Thirty-foot, Gordon and Fourth. The principal gas producing areas are confined to those portions of the district that have a comparatively high structural level, or along the western border and in the southeast corner. A discussion of the several oil and gas pools and the logs of wells therein will now be taken up roughly from west to east across the district.

Along the western edge of Mannington district there occur 20 to 25 gas wells on the eastern flank of the Hundred anticline. The three following records from scattered borings in this field show that the main producing sands are the Maxton, Big Injun and Fourth:

#### **Geo. T. Hamilton No. 1 Well Record (359).**

Mannington district, 2.7 miles northwest of Seven Pines. Authority, Carnegie Natural Gas Company. Completed Oct. 16, 1909.

| (Elevation, 1235' B.A.T.)   | Thickness<br>Feet. | Total<br>Feet. |
|---|--------------------|----------------|
| Unrecorded .....  | 1000               | 1000           |
| Pittsburgh coal .....   | 8                  | 1008           |
| Unrecorded .....  | 1262               | 2270           |
| Big Injun sand (little water, 1769'; small oil show, 2130'; little gas, 2330.; big gas, 2337') and unrecorded to bottom ..... | 85                 | 2355           |

10" casing, 188'; 6½" casing, 2222'; 3" tubing, 2355'. Packed with Anchor Packer at 2300'. 0.8 mercury in 6½" casing.

The mercury gage test is equivalent to a 5,450,000 cu. ft. of gas daily.

## Calvin Hamilton No. 1 Well Record (362).

Mannington district, 2.3 miles northwest of Seven Pines. Authority, Carnegie Natural Gas Company. Completed Oct. 12, 1907.

| (Elevation, 1235' B-A.T.)                                  | Thickness<br>Feet. | Total<br>Feet |
|--|--------------------|---------------|
| Unrecorded .....   | 990                | 990           |
| Coal, Pittsburgh .....                                     | 8                  | 998           |
| Unrecorded .....   | 1116               | 2114          |
| Maxton sand .....  | 100                | 2214          |
| Unrecorded .....   | 58                 | 2272          |
| Big Injun sand (gas, 2276' and 2293') .....                | 180                | 2452          |
| Unrecorded .....   | 298                | 2750          |
| Sand, Gantz? (Berea) .....                                 | 70                 | 2820          |
| Unrecorded .....   | 85                 | 2905          |
| Fifty-foot sand .....                                      | 45                 | 2950          |
| Unrecorded .....   | 68                 | 3018          |
| Gordon Stray sand .....                                    | 38                 | 3056          |
| Unrecorded .....   | 18                 | 3074          |
| Gordon sand (gas, 3104', steel line measurement) .....     | 59                 | 3133          |
| Unrecorded .....   | 14                 | 3147          |
| Fourth sand (big gas, 3158', steel line measurement) ..... | 30                 | 3177          |
| Unrecorded to bottom .....                                 | 0'8"               | 3177'8"       |

10" casing, 198'; 8½" casing, 1421'; 6½" casing, 2330'; 3" tubing, 2778'.

## Pressure test in 3" tubing:

|                        |                       |
|------------------------|-----------------------|
| 1st ¼ minute, 160 lbs. | 15th minute, 765 lbs. |
| 1st minute, 210 lbs.   | 30th minute, 790 lbs. |
| 4th minute, 500 lbs.   |                       |

## Later test in 3" tubing:

|                        |                         |
|------------------------|-------------------------|
| 1st ¼ minute, 240 lbs. | 5th minute, 750 lbs.    |
| 1st minute, 320 lbs.   | 10th minute, 820 lbs.   |
| 2nd minute, 500 lbs.   | 20th minute, 865 lbs.   |
| 3rd minute, 620 lbs.   | Two hours, 940 lbs.     |
| 4th minute, 700 lbs.   | Rock pressure, 980 lbs. |

In the above record the Pittsburgh coal—Fourth sand interval is 40 to 60 feet less than in the central and eastern portions of Mannington district, owing to the general westward thinning of the Carboniferous measures.

## James Toothman No. 1 Well Record (364).

Mannington district, 1.4 miles north of Brink. Authority, Hope Natural Gas Company. Completed in 1911.

| (Elevation, 1355' B-A.T.)         | Thickness<br>Feet. | Total<br>Feet. |
|-----------------------------------|--------------------|----------------|
| Unrecorded .....                  | 750                | 750            |
| Bluff sand and unrecorded .....   | 210                | 960            |
| Coal, Mapletown (Sewickley) ..... | 6                  | 966            |
| Unrecorded .....                  | 94                 | 1060           |
| Pittsburgh coal .....             | ..                 | 1060           |

|  | Thickness.<br>Feet. | Total.<br>Feet. |
|--|---------------------|-----------------|
| Unrecorded .....   | 470                 | 1530            |
| Big Dunkard sand .....   | 50                  | 1580            |
| Unrecorded .....   | 120                 | 1700            |
| Gas sand .....   | 80                  | 1780            |
| Unrecorded .....   | 40                  | 1820            |
| Salt sand (water, 1880') .....   | 70                  | 1890            |
| Unrecorded .....   | 5                   | 1895            |
| Second Salt sand (water, 1900' and 1930') .....  | 50                  | 1945            |
| Red rock .....   | 230                 | 2175            |
| Maxton sand (gas, 2182'-2193'; shell, 2194'; gas increase,<br>2194'-2197') to bottom ..... | 22                  | 2197            |
| 10" casing, 1387'; 8½" casing, 2000'; 2/10 mercury in 8½" casing.                          |                     |                 |

The mercury test is equivalent to 4,225,000 cu. ft. of gas daily, a very good production from the Maxton.

On the headwaters of Buffalo creek to the northwest of Glover Gap there occurs a pool of 45 to 50 oil wells in the Thirty-foot sand down near the axis of the Robinson Basin in ideal conformity with the anticlinal theory of the accumulation of oil and gas, since the latter sand is non-water bearing in this part of the State. Development in this field started about five years ago, the initial oil production of the wells ranging from 10 to 200 barrels. The wells fell off rapidly, however, from their first production, so that not so much profit was made by the operators as in the Big Injun, Gordon and Fourth sand pools in the same district. The three following records from wells in this field give interesting data with reference to the sands and the minable coals:

#### L. A. Keenan No. 1 Well Record (348).

Mannington district, 1.9 miles N 30° W of Glover Gap. Authority, South Penn Oil Company. Completed May 2, 1908.

| (Elevation, 1135' B.A.T.)                        | Thickness<br>Feet. | Total<br>Feet. |
|--|--------------------|----------------|
| Conductor .....                                  | 16                 | 16             |
| Unrecorded .....                                 | 444                | 460            |
| Coal, native, (Washington) .....                 | 2                  | 462            |
| Unrecorded .....                                 | 412                | 874            |
| Coal, Mapletown (Sewickley) and unrecorded ..... | 95                 | 969            |
| Pittsburgh coal .....                            | 7                  | 976            |
| Unrecorded .....                                 | 362                | 1338           |
| Little Dunkard sand .....                        | 25                 | 1363           |
| Unrecorded .....                                 | 75                 | 1438           |
| Big Dunkard sand .....                           | 42                 | 1480           |
| Unrecorded .....                                 | 244                | 1724           |
| II Cow Run sand .....                            | 21                 | 1745           |

|  | Thickness. |                 |
|--|------------|-----------------|
|  | Feet.      | Total.<br>Feet. |
| Unrecorded .....   | 20         | 1765            |
| First Salt sand .....                                    | 85         | 1850            |
| Unrecorded .....   | 45         | 1895            |
| Second Salt sand .....                                   | 10         | 1905            |
| Unrecorded .....   | 182        | 2087            |
| Maxton sand (gas, 2107'; heavy, 2117') and unrecorded... | 35         | 2122            |
| Little Lime .....  | 13         | 2135            |
| Pencil cave .....  | 10         | 2145            |
| Big Lime .....   | 95         | 2240            |
| Big Injun sand .....                                     | 170        | 2410            |
| Unrecorded .....   | 8          | 2418            |
| Squaw sand .....   | 4          | 2422            |
| Unrecorded .....   | 468        | 2890            |
| Fifty-foot sand .....                                    | 57         | 2947            |
| Unrecorded .....   | 31         | 2978            |
| Thirty-foot sand (gas, 2987'; oil, 2990'-2995') .....    | 22         | 3000            |
| Unrecorded .....   | 5          | 3005            |
| Sand .....   | 4          | 3009            |
| Unrecorded .....   | 5          | 3014            |
| Sand .....   | 11         | 3025            |
| Unrecorded .....   | 10         | 3035            |
| Sand and unrecorded .....                                | 37         | 3072            |
| Gordon Stray sand .....                                  | 33         | 3105            |
| Unrecorded .....   | 3          | 3108            |
| Gordon sand .....  | 19         | 3127            |
| Unrecorded .....   | 25         | 3152            |
| Fourth sand .....  | 26         | 3178            |
| Unrecorded .....   | 31         | 3209            |
| Fifth sand .....   | 10         | 3219            |
| Unrecorded to bottom .....                               | 21         | 3240            |

Original test 28/10 mercury in 5 $\frac{1}{8}$ " opening for Maxton sand (equivalent to 6,200,000 cu. ft. daily).

Rock pressure, 630 lbs. in 60 minutes. Shot March 28, 1910, in "Thirty-foot" with 50 quarts, 4 $\frac{1}{2}$ " shell, top, 2895'.

### John Glover No. 1 Well Record (351).

Located in Mannington district, 1.1 miles northwest of Glover Gap. Authority, Fisher Oil Company. Completed Oct. 22, 1910.

|  | Thickness |                |
|--|-----------|----------------|
|  | Feet.     | Total<br>Feet. |
| (Elevation, 1460'B-A.T.)               |           |                |
| Unrecorded .....                       | 1185      | 1185           |
| Coal, Mapletown (Sewickley) .....      | 5         | 1190           |
| Unrecorded .....                       | 90        | 1280           |
| Coal, Pittsburgh .....                 | 10        | 1290           |
| Unrecorded .....                       | 1220      | 2510           |
| Big Lime .....                         | 75        | 2585           |
| Big Injun sand .....                   | 170       | 2755           |
| Unrecorded .....                       | 495       | 3250           |
| Fifty-foot sand .....                  | 25        | 3275           |
| Unrecorded .....                       | 26        | 3301           |
| Thirty-foot (oil) sand to bottom ..... | 19        | 3320           |

Conductor, 16'; 10" casing, 416'; 8 $\frac{1}{4}$ " casing, 1767'; 6-5/8" casing, 2695'.

Shot Dec. 29, 1910, with 20 quarts from 3312' to 3319'. Well filled up half full of oil one hour after shot.

**A. M. Glover No. 3 Well Record (355).**

Mannington district, 0.6 mile northwest of Glover Gap. Authority, Venture Oil Company. Commenced Feb. 24, 1910.

| (Elevation, 1070' B.A.T.)  | Thickness<br>Feet. | Total<br>Feet. |
|--|--------------------|----------------|
| Unrecorded .....   | 450                | 450            |
| Bluff sand .....   | 58                 | 508            |
| Waynesburg coal .....  | 4                  | 512            |
| Unrecorded .....   | 243                | 755            |
| Mapletown (Sewickley) coal .....   | 5                  | 760            |
| Unrecorded .....   | 97                 | 857            |
| Pittsburgh coal .....  | 6                  | 863            |
| Unrecorded .....   | 1220               | 2083           |
| Pencil cave .....  | 3                  | 2086           |
| Big Lime .....   | 77                 | 2163           |
| Big Injun sand .....   | 150                | 2313           |
| Unrecorded .....   | 467                | 2780           |
| Fifty-foot sand .....  | 67                 | 2847           |
| Unrecorded .....   | 37                 | 2884           |
| Thirty-foot sand (oil, 2890'-2900') .....                                  | 19                 | 2903           |
| 10" casing, 310'; 8½" casing, 1308'; 6¾" casing, 2100'; 5½" casing, 2416'. |                    |                |

The following is the record of a well in the northwest edge of this Thirty-foot sand oil pool that proved dry at the latter horizon, but gas was encountered in the Maxton, Big Injun, and Fifty-foot, and oil in the Gordon Stray and Gordon:

**Dorcas (T. J.) Ash No. 3 Well Record (347).**

Mannington district, 1.9 miles northwest of Glover Gap. Authority, South Penn Oil Company. Completed in 1909.

| (Elevation, 1100' B.A.T.)                              | Thickness<br>Feet. | Total<br>Feet. |
|--|--------------------|----------------|
| Conductor .....  | 16                 | 16             |
| Unrecorded .....                                       | 494                | 510            |
| Bluff sand .....                                       | 30                 | 540            |
| Unrecorded .....                                       | 274                | 814            |
| Coal, Mapletown (Sewickley) .....                      | 3                  | 817            |
| Unrecorded .....                                       | 101                | 918            |
| Pittsburgh coal (steel line measurement) .....         | 7                  | 925            |
| Unrecorded .....                                       | 79                 | 1004           |
| Sand, (Minshall) .....                                 | 41                 | 1045           |
| Unrecorded .....                                       | 332                | 1377           |
| Little Dunkard sand (steel line measurement) .....     | 50                 | 1427           |
| Unrecorded .....                                       | 218                | 1645           |
| Gas and II Cow Run sand .....                          | 204                | 1749           |
| Unrecorded .....                                       | 59                 | 1808           |
| First Salt sand .....                                  | 72                 | 1880           |
| Unrecorded .....                                       | 25                 | 1905           |
| Second Salt sand and unrecorded .....                  | 122                | 2027           |
| Maxton sand (gas, 2035'; steel line measurement) ..... | 49                 | 2076           |
| Unrecorded .....                                       | 29                 | 2105           |

|   | Thickness. | Total. |
|---|------------|--------|
|   | Feet.      | Feet.  |
| Pencil cave .....   | 5          | 2110   |
| Big Lime .....  | 86         | 2196   |
| Big Injun sand (gas show, 2206'; steel line measurement).....   | 164        | 2360   |
| Unrecorded .....  | 484        | 2844   |
| Fifty-foot sand (gas, 2893'; steel line measurement).....   | 60         | 2904   |
| Unrecorded .....  | 29         | 2933   |
| Thirty-foot sand .....  | 33         | 2966   |
| Unrecorded .....  | 10         | 2976   |
| Red rock .....  | 6          | 2982   |
| Unrecorded .....  | 48         | 3030   |
| Gordon Stray sand (oil show, 3042'; steel line measurement) and unrecorded .....  | 34         | 3064   |
| Gordon sand (oil, 3066'; steel line measurement) to bottom<br>Still in Gordon sand.<br>10" casing, 156'; 8½" casing, 1411'; 6½" casing, 2137'; 5½" casing, 3067'. | 13         | 3077   |

Southwestward along the axis of the Robinson Basin from the Glover Gap Thirty-foot oil pool, dry holes were drilled on the Solomon Glover (356) and J. L. Hamilton (360) farms, located 1.6 miles southwest of Glover Gap and 1.3 miles northwest of Seven Pines, respectively.

Passing on southwestward along the axis of the same basin, another small oil pool consisting of about a dozen producers is found, on Warrior fork, 1 mile southwest of Seven Pines. The oil occurs in the Maxton and Gordon as shown by the log of the **Joseph Hayhurst No. 1 well (374)**, located at the mouth of Evans run, as published on page 173 of Vol. I(A) of the State Survey reports. The log of the **Rachel Evans No. 1** dry hole (375), located 0.7 mile westward, is published on page 165 of the same report.

The following is the log of a Maxton oil well in the above mentioned pool:

#### Joseph Hayhurst No. 4 Well Record (373).

Mannington district, 1.1 miles northwest of Rymer. Authority, South Penn Oil Company. Completed May 19, 1909.

|  | Thickness | Total |
|--|-----------|-------|
|  | Feet.     | Feet. |
| (Elevation, 1065' B.A.T.)                      |           |       |
| Conductor .....                                | 15        | 15    |
| Unrecorded .....                               | 775       | 790   |
| Mapletown (Sewickley) coal .....               | ..        | 790   |
| Unrecorded .....                               | 90        | 880   |
| Pittsburgh coal (steel line measurement) ..... | ..        | 880   |
| Unrecorded .....                               | 480       | 1360  |
| Big Dunkard sand .....                         | 40        | 1400  |



|  | Thickness. | Total. |
|--|------------|--------|
|  | Feet.      | Feet.  |
| Unrecorded .....   | 149        | 1549   |
| Gas sand .....   | 195        | 1744   |
| Unrecorded .....   | 36         | 1780   |
| Salt sand .....  | 123        | 1903   |
| Unrecorded .....   | 29         | 1932   |
| Sand .....   | 33         | 1965   |
| Unrecorded .....   | 50         | 2015   |
| Maxton sand (oil, 2046' and 2062') .....                                     | 54         | 2069   |
| Unrecorded to bottom (steel line measurement) .....                          | 2          | 2071   |
| 10" casing, 287'; 8½" casing, 1360'; 6¾" casing, 1912'; hole reduced, 2022'. |            |        |

The two following are very complete records from wells located one mile southward along the Robinson synclinal axis. The first had a show of oil in the Maxton and gas in the Stray; the second was a gasser in the Big Injun with a show of oil in the Fourth sand:

#### Riley Arnett No. 2 Well Record (371).

Mannington district, 1.7 miles S 85° W of Rymer. Authority, South Penn Oil Company.

| (Elevation, 1120' B-A.T.)   | Thickness | Total |
|---|-----------|-------|
|   | Feet.     | Feet. |
| Conductor .....   | 16        | 16    |
| Slate and shells .....  | 231       | 247   |
| Slate .....   | 78        | 325   |
| Limestone .....   | 55        | 380   |
| Slate .....   | 70        | 450   |
| Coal, (Washington) .....  | 4         | 454   |
| Slate .....   | 71        | 525   |
| Limestone .....   | 50        | 575   |
| Sand .....  | 50        | 625   |
| Slate .....   | 25        | 650   |
| Limestone .....   | 60        | 710   |
| Slate .....   | 15        | 725   |
| Limestone .....   | 135       | 860   |
| Coal, (Sewickley) .....   | 4         | 864   |
| Limestone .....   | 88        | 952   |
| Coal, Pittsburgh .....  | 5         | 957   |
| Red rock, limestone, sand and slate in alternate layers,<br>no coal ..... | 1074      | 2031  |
| Red rock .....  | 45        | 2076  |
| Sand, (Maxton) (oil show, 2115'-2119') .....                              | 57        | 2133  |
| Shale .....   | 17        | 2150  |
| Limestone (Big Lime) .....  | 75        | 2225  |
| Big Injun sand .....  | 158       | 2383  |
| Slate .....   | 69        | 2452  |
| Limestone .....   | 76        | 2528  |
| Slate .....   | 57        | 2585  |
| Limestone .....   | 13        | 2598  |
| Slate and shells .....  | 8         | 2606  |

|   | Thickness. | Total. |
|---|------------|--------|
|   | Feet.      | Feet.  |
| Limestone .....   | 124        | 2730   |
| Sand .....  | 3          | 2733   |
| Slate .....   | 41         | 2774   |
| Limestone .....   | 46         | 2820   |
| Sand, (Fifty-foot) .....                                | 38         | 2858   |
| Slate .....   | 10         | 2868   |
| Sand .....  | 12         | 2880   |
| Slate .....   | 26         | 2906   |
| Limestone .....   | 19         | 2925   |
| Red rock .....  | 16         | 2941   |
| Sand, (Thirty-foot) .....                               | 33         | 2974   |
| Slate .....   | 13         | 2987   |
| Sand, (Stray and Gordon) (gas, 3023') .....             | 118        | 3105   |
| Slate .....   | 21         | 3126   |
| Sand, (Fourth) .....                                    | 50         | 3176   |
| Slate to bottom.....                                    | 44         | 3220   |
| 10" casing, 247'; 8½" casing, 1385'; 6½" casing, 2274'. |            |        |

Riley Arnett No. 1 Well Record (372).

Mannington district, 1.1 miles west of Rymer. Authority, South Penn Oil Company. Completed July 9, 1893.

|  | Thickness          | Total |    |
|--|--------------------|-------|----|
|  | Feet.              | Feet. |    |
| (Elevation, 1055' B-A. T.)                     |                    |       |    |
| Sand and red rock.....                         | 250                | 250   |    |
| Limestone .....                                | 50                 | 300   |    |
| Slate .....                                    | 50                 | 350   |    |
| Coal, (Washington) .....                       | 12                 | 362   |    |
| Slate and limestone .....                      | 103                | 465   |    |
| Sand .....                                     | 35                 | 500   |    |
| Coal, (Waynesburg) .....                       | 5                  | 505   |    |
| Slate .....                                    | 20                 | 525   |    |
| Sand .....                                     | 15                 | 540   |    |
| Slate .....                                    | 95                 | 635   |    |
| Limestone .....                                | 110                | 745   |    |
| Slate .....                                    | 24                 | 769   |    |
| Mapletown (Sewickley) coal .....               | 5                  | 774   |    |
| Slate and limestone .....                      | 98                 | 872   |    |
| Pittsburgh coal .....                          | 13                 | 885   |    |
| Cave .....                                     | 20                 | 905   |    |
| Limestone .....                                | 35                 | 940   |    |
| Slate .....                                    | 30                 | 970   |    |
| Sand (water) (Minshall) .....                  | 50                 | 1020  |    |
| Lime, reds, slate and sand, with no coal ..... | 920                | 1940  |    |
| Red rock .....                                 | 30                 | 1970  |    |
| Sand, (Maxton) .....                           | 105                | 2075  |    |
| Limestone (Big Lime) (cased 6½" at 2113')..... | 73                 | 2148  |    |
| Sand, dark gray (gas show, 2174').36'.         | } Big Injun sand.. | 2370  |    |
| Sand, hard, white .....                        |                    |       | 6  |
| Sand and limestone.....                        |                    |       | 40 |
| Sand, hard, white .....                        |                    |       | 10 |
| Sand, soft (gas show, 2234').....              |                    |       | 12 |
| Slate .....                                    |                    |       | 3  |
| Sand, hard, white .....                        |                    |       | 37 |
| Slate .....                                    |                    |       | 39 |
| Limestone .....                                |                    |       | 30 |
| Sand .....                                     |                    |       | 20 |

|   | Thickness.<br>Feet. | Total<br>Feet. |
|---|---------------------|----------------|
| Limestone .....                                       | 50                  | 2420           |
| Slate .....   | 40                  | 2460           |
| Sand and limestone .....                              | 50                  | 2510           |
| Slate and shells .....                                | 140                 | 2650           |
| Limestone and slate .....                             | 50                  | 2700           |
| Sand and shells .....                                 | 20                  | 2720           |
| Slate and shells .....                                | 35                  | 2755           |
| Sand, (Gantz) .....                                   | 65                  | 2820           |
| Slate and sand shells .....                           | 20                  | 2840           |
| Sand (Fifty-foot, Thirty-foot, Stray and Gordon)..... | 192                 | 3032           |
| Slate .....   | 53                  | 3085           |
| Sand shells (Fourth) (oil show, 3086') .....          | 3                   | 3088           |
| Slate, dark .....                                     | 40                  | 3128           |
| Shell, dark .....                                     | 1                   | 3129           |
| Slate, dark .....                                     | 40                  | 3169           |
| Shell, dark .....                                     | 1                   | 3170           |
| Slate, dark .....                                     | 30                  | 3200           |
| Shell, dark .....                                     | 1                   | 3201           |
| Slate, dark .....                                     | 19                  | 3220           |
| Shell, dark .....                                     | 1                   | 3221           |
| Slate to bottom .....                                 | 76                  | 3297           |

10" casing, 262'; 8½" casing, 1057'; 6½" casing, 2113'.

One mile westward in the vicinity of Brink there occurs a small oil pool, consisting of about a dozen wells in the Big Injun sand. The following log is from this pool:

#### John Ott No. 1 Well Record (367).

Mannington district, 0.5 mile northeast of Brink. Authority South Penn Oil Company. Completed Dec. 27, 1898.

|   | Thickness.<br>Feet. | Total.<br>Feet. |
|---|---------------------|-----------------|
| Conductor .....   | 16                  | 16              |
| Unrecorded .....  | 891                 | 907             |
| Pittsburgh coal.....  | 8                   | 915             |
| Unrecorded .....  | 1213                | 2128            |
| Big Lime.....   | 70                  | 2198            |
| Big Injun sand (gas, heavy flow, 2198'-2213'; first oil pay. 2303') and unrecorded to bottom..... | 127                 | 2325            |

"10" casing, 537'; 8¼" casing, 1427'; 6½" casing, 2176'; 5½" casing, 2230'; hole reduced to 4¼" at 2230'."

Slightly over a mile west of Curtisville a Gordon sand oil pool occurs, consisting of 35 to 40 producing wells that were drilled about 10 years ago. Situated as it is in the low point of the Robinson Basin, it conforms ideally to the anticlinal theory in its accumulation. The three following records are from wells in this pool:

**W. N. Cunningham No. 4 Well Record (462).**

Mannington district, 1.3 miles N 85° W of Curtisville. Authority, South Penn Oil Company. Completed July 8, 1902.

| (Elevation, 1075' B-A. T.)  | Thickness. Total. |       |
|---|-------------------|-------|
|   | Feet.             | Feet. |
| Conductor .....   | 16                | 16    |
| Unrecorded .....  | 788               | 804   |
| Mapletown (Sewickley) coal.....   | 5                 | 809   |
| Unrecorded .....  | 106               | 915   |
| Pittsburgh coal.....  | 8                 | 923   |
| Unrecorded .....  | 1315              | 2238  |
| Big Injun sand (water, hole full, 2315').....   | 122               | 2360  |
| Unrecorded .....  | 610               | 2970  |
| Gordon Stray sand.....  | 16                | 2986  |
| Unrecorded .....  | 4                 | 2990  |
| Gordon sand (first oil pay, 3004') and unrecorded to bottom .....   | 23                | 3013  |
| 10" casing, 253'; 8¼" casing, 1419' 4"; 6½" casing, 2339' 9". Shot with 20 quarts; 6' shell, top, 3003'. Shot Aug. 7, 1905, with 37 quarts; 7"x4¼" shell, top, 3003'. |                   |       |

**Jacob Cunningham No. 9 Well Record (464).**

Mannington district, 1.4 miles S 75° W of Curtisville. Authority, South Penn Oil Company. Completed Sept. 19, 1903.

| (Elevation, 1070' B-A. T.)  | Thickness. Total. |       |
|---|-------------------|-------|
|   | Feet.             | Feet. |
| Conductor .....   | 16                | 16    |
| Unrecorded .....  | 784               | 800   |
| Mapletown (Sewickley) coal.....   | 5                 | 805   |
| Unrecorded .....  | 90                | 895   |
| Pittsburgh coal.....  | 7                 | 902   |
| Unrecorded .....  | 1214              | 2116  |
| Big Lime .....  | 70                | 2186  |
| Big Injun sand (water, 2305').....  | 124               | 2310  |
| Unrecorded .....  | 478               | 2788  |
| Fifty-foot sand.....  | 20                | 2808  |
| Unrecorded .....  | 159               | 2967  |
| Gordon Stray sand.....  | 13                | 2980  |
| Unrecorded .....  | 12                | 2992  |
| Gordon sand (first pay, 2995'; second, 3000') and unrecorded to bottom.....   | 23                | 3015  |
| "10" casing, 264'; 8¼" casing, 1409'; 6½" casing, 2253'; 5½" casing, 2415'.<br>Shot Aug. 21, 1903, with 20 quarts; 4' shell, top, 2996'.<br>First production, 20 barrels daily. |                   |       |

**Jacob Cunningham No. 3 Well Record (465).**

Mannington district, 1.8 miles S 70° W of Curtisville. Authority, South Penn Oil Company. Completed March 24, 1902.

| (Elevation, 1155' B-A. T.) | Thickness. Total. |       |
|----------------------------|-------------------|-------|
|                            | Feet.             | Feet. |
| Conductor .....            | 16                | 16    |
| Unrecorded .....           | 919               | 935   |

|   | Thickness.<br>Feet. | Total.<br>Feet. |
|---|---------------------|-----------------|
| Mapletown (Sewickley) coal.....   | ...                 | 935             |
| Unrecorded .....  | 100                 | 1035            |
| Pittsburgh coal .....   | ...                 | 1035            |
| Unrecorded .....  | 770                 | 1805            |
| Gas sand (water, 1890').....  | 103                 | 1908            |
| Unrecorded .....  | 340                 | 2248            |
| Big Lime .....  | 80                  | 2328            |
| Big Injun sand (water, 2338' and 2413').....  | 120                 | 2448            |
| Unrecorded .....  | 635                 | 3083            |
| Gordon Stray sand.....  | 29                  | 3112            |
| Unrecorded .....  | 5                   | 3117            |
| Gordon sand (first pay, 3127'; second, 3129') and unrec-<br>orded to bottom.....  | 21                  | 3138            |
| 10" casing, 225'; 8¼" casing, 1463' 9"; 6½" casing, 2245' 5"; 5⅜"<br>casing, 2450' 5"; 4½" x 4" casing, 179' (bottom at 3117'). |                     |                 |
| Production first 24 hours, 37½ barrels. Shot with 16 quarts, 8'<br>shell top at 3127'.  |                     |                 |

The log of the W. N. Cunningham No. 1 (463), located in this pool, 0.9 mile northward, is published on pages 173-174 of Vol. I(A) of the State Survey reports.

**Campbell Run Oil Pool.**—What is known as the Campbell Run oil pool consists of 80 to 100 producing oil wells included within the boundaries of Mannington district, extending southwest from the Monongalia-Marion county line on the waters of Campbell run and Pyle's fork to near the head of State Road fork. The producing sands therein are the Big Injun, Gordon and Fourth. The initial production of some of the Gordon sand wells was over 3000 barrels of oil daily, many making 1500 to 2000 barrels. The Big Injun and Fourth sand wells were not nearly so large but held up better. Considered structurally the pool lies down near the foot of the east slope of the Robinson syncline and is suddenly terminated to the southwest by a local anticlinal bulge, slightly over a mile southward from Glover Gap, along the crest of which fold there occur one-half dozen gas wells. Out of the large number drilled, the seven following records from wells in this field exhibit the rock succession, the depths of the several oil pays and other data of economic interest:

**Isaac Campbell No. 5 Well Record (421).**

Mannington district, 2.3 miles north of Metz. Authority, South Penn Oil Company. Completed to 3168', Feb. 8, 1899.

|   | Thickness. | Total. |
|---|------------|--------|
|   | Feet.      | Feet.  |
| Unrecorded .....  | 990        | 990    |
| Pittsburgh coal .....   | ...        | 990    |
| Unrecorded .....  | 1233       | 2223   |
| Big Lime .....  | 67         | 2290   |
| Big Injun sand (gas, 2310'; water, 2400') .....                     | 160        | 2450   |
| Unrecorded .....  | 435        | 2885   |
| Gantz sand .....  | 15         | 2900   |
| Unrecorded .....  | 40         | 2940   |
| Fifty-foot sand .....   | 40         | 2980   |
| Unrecorded .....  | 5          | 2985   |
| Thirty-foot sand .....  | 20         | 3005   |
| Unrecorded .....  | 133        | 3138   |
| Stray sand .....  | 10         | 3148   |
| Unrecorded .....  | 6          | 3154   |
| Gordon sand (oil, 3154') and unrecorded .....                       | 48         | 3202   |
| Gordon sand .....   | 8          | 3210   |
| Unrecorded .....  | 25         | 3235   |
| Fourth sand (oil, 3240'; gas, 3244') and unrecorded to bottom ..... | 23         | 3258   |

The above well had an initial production of 800 bbls. of oil daily from the Gordon sand. Six years later it was drilled on down through the Fourth, making 10 bbls. daily from that horizon.

**Isaac Campbell No. 2 Well Record (420).**

Mannington district, 2.4 miles north of Metz. Authority, South Penn Oil Company. Completed Aug. 16, 1898.

|   | Thickness. | Total. |
|---|------------|--------|
|   | Feet.      | Feet.  |
| Unrecorded .....  | 1006       | 1006   |
| Pittsburgh coal .....                                   | 9          | 1015   |
| Unrecorded .....  | 1225       | 2240   |
| Big Lime .....  | 60         | 2300   |
| Big Injun sand (water, 2410') .....                     | 170        | 2470   |
| Unrecorded .....  | 686        | 3156   |
| Gordon sand (oil, 3162', 3166') .....                   | 10         | 3166   |
| (Drilled deeper Sept. 19, 1907).                        |            |        |
| Unrecorded .....  | 88         | 3254   |
| Fourth sand (oil, 3258') and unrecorded to bottom ..... | 21         | 3275   |

The above well had an initial oil production of 200 bbls. daily. About 6 years later it was drilled on down through the Fourth, making an initial production of 30 bbls. daily from that sand and was still producing in August, 1911, 5 bbls. daily.

**James Fox No. 1 Well Record (419).**

Mannington district, 3 miles southwest of Mannington. Authority, South Penn Oil Company.

| (Elevation, 1190' B-A. T.)  | Thickness. Total. |      |
|---|-------------------|------|
|   | Feet.             | Feet |
| Conductor .....   | 10                | 10   |
| Unrecorded .....  | 900               | 910  |
| Mapletown (Sewickley) coal.....   | 5                 | 915  |
| Unrecorded .....  | 85                | 1000 |
| Pittsburgh coal.....  | 8                 | 1008 |
| Unrecorded .....  | 1247              | 2255 |
| Big Lime .....  | 90                | 2345 |
| Big Injun sand (water, 2420').....  | 167               | 2512 |
| Unrecorded .....  | 615               | 3127 |
| Gordon Stray sand.....  | 15                | 3142 |
| Break .....   | 3                 | 3145 |
| Gordon sand (first oil pay, 3169'; second, 3180') and unrecorded to bottom..... | 53                | 3198 |
| 10" casing, 260'; 8¼" casing, 1393' 7".   |                   |      |

**Eliz. Thomas No. 1 Well Record (416).**

Mannington district, 2.1 miles northeast of Metz. Authority, South Penn Oil Company. Completed March 12, 1898.

| (Elevation, 1086' L-A.T.)  | Thickness. Total. |       |
|--|-------------------|-------|
|  | Feet.             | Feet. |
| Unrecorded .....   | 800               | 800   |
| Coal, Mapletown (Sewickley) .....  | 5                 | 805   |
| Unrecorded .....   | 95                | 900   |
| Pittsburgh coal .....  | 10                | 910   |
| Unrecorded .....   | 1210              | 2120  |
| Big Lime .....   | 55                | 2175  |
| Sand, Big Injun .....  | 58                | 2233  |
| Red sand .....   | 15                | 2248  |
| Big Injun sand .....   | 87                | 2335  |
| Unrecorded .....   | 720               | 3055  |
| Gordon sand (oil, 3064') .....   | 17                | 3072  |
| Unrecorded .....   | 58                | 3130  |
| Gordon sand .....  | 10                | 3140  |
| Unrecorded .....   | 16                | 3156  |
| Fourth sand and unrecorded to bottom.....                                    | 22                | 3178  |
| 10" casing, 184'; 6½" casing, 1883'; 5½" casing, 2370'; 4½"x4" casing, 256'. |                   |       |

No oil was reported in the Fourth sand.

The I. E. Arnett No. 1 well (415), located 0.2 mile southward, had an initial oil production of 300 bbls. daily from the Gordon.

**Thos. P. Freeland No. 1 Well Record (403).**

Mannington district, 1.1 miles northwest of Metz. Authority,  
South Penn Oil Company. Completed April 12, 1900.

|  | Thickness. Total. |       |
|--|-------------------|-------|
| (Elevation, 1015' B-A.T.)  | Feet.             | Feet. |
| Conductor .....  | 16                | 16    |
| Unrecorded .....   | 739               | 755   |
| Coal, Pittsburgh .....   | 7                 | 762   |
| Unrecorded .....   | 1308              | 2070  |
| Big Injun sand (oil, 2170') to bottom.....                       | 114               | 2184  |
| 10" casing, 212'; 8½" casing, 1258'; 6½" casing, 2634'           |                   |       |
| May 4th, shot with 16 quarts; 8' shell; top of shot, 2169'.      |                   |       |
| March 20th, shot with 20 quarts; 7'8" shell; top of shot, 2170'. |                   |       |

**Snodgrass Bros. No. 3 Well Record (394).**

Mannington district, 0.6 mile southeast of Glover Gap. Authority,  
Freehold Oil & Gas Company. Completed Aug. 13, 1907.

|   | Thickness. Total. |       |
|---|-------------------|-------|
| (Elevation, 1055' B-A.T.)   | Feet.             | Feet. |
| Unrecorded .....  | 712               | 712   |
| Mapletown (Sewickley) coal .....  | ...               | 712   |
| Unrecorded .....  | 100               | 812   |
| Pittsburgh coal .....   | ...               | 812   |
| Unrecorded .....  | 1293              | 2105  |
| Big Injun sand (3 bailers water, 2117'; little gas, 2152';<br>little gas and heavy water, 2209')..... | 641               | 2746  |
| Gantz sand and unrecorded (little water, 2816').....  | 109               | 2855  |
| Thirty-foot sand .....  | 25                | 2880  |
| Unrecorded .....  | 30                | 2910  |
| Sand and unrecorded .....   | 45                | 2955  |
| Sand and unrecorded .....   | 23                | 2978  |
| Campbell's Run (Gordon) sand (oil, 2982') and unrecorded<br>to bottom .....                           | 24                | 3002  |

The small water pay at 2816 feet is unusual in formations  
below the Big Injun in this portion of the State.

**Benj. Dodd No. 3 Well Record (389).**

Mannington district, 0.8 mile S 5° E of Glover Gap. Authority,  
South Penn Oil Company. Completed April 19, 1894.

|                                       | Thickness. Total. |       |
|---------------------------------------|-------------------|-------|
| (Elevation, 1255' B-A.T.)             | Feet.             | Feet. |
| Conductor .....                       | 16                | 16    |
| Unrecorded (water, 90') .....         | 644               | 660   |
| Bluff sand .....                      | 15                | 675   |
| Unrecorded .....                      | 235               | 910   |
| Coal, Mapletown (Sewickley) .....     | 4                 | 914   |
| Unrecorded .....                      | 94                | 1008  |
| Coal, Pittsburgh .....                | 12                | 1020  |
| Unrecorded .....                      | 660               | 1680  |
| Gas sand (water and gas, 1790') ..... | 140               | 1820  |
| Unrecorded .....                      | 105               | 1925  |



|   | Thickness. Total. |       |
|---|-------------------|-------|
|   | Feet.             | Feet. |
| Salt sand .....   | 120               | 2045  |
| Unrecorded .....  | 180               | 2225  |
| Pencil cave .....   | 15                | 2240  |
| Big Lime .....  | 78                | 2318  |
| Big Injun sand (salt water, 2322'; oil, 2418'; water, 2421')<br>and unrecorded to bottom..... | 130               | 2448  |
| 10" casing, 228'; 8½" casing, 1490'; 6½" casing, 2080'; 5½"<br>casing, 2383'.                 |                   |       |

In addition to the brief records as given in the Marion county table of wells, the much more complete logs of the following from the Campbell Run oil pool are given on the pages indicated in Vol. I(A) of the State Survey reports:

| No. on<br>Map II. | Name of Well.              | Location.                   | Page of<br>Vol. I(A) |
|-------------------|----------------------------|-----------------------------|----------------------|
| 396               | Iusetta Snodgrass No. 1... | Metz, 1.6 miles N 50° W of. | 166                  |
| 398               | Aaron Furbee No. 1.....    | Metz, 1.5 miles N 40° W of. | 165                  |
| 402               | Lemley & Hibbs No. 1.....  | Metz, 1.3 miles N 40° W of. | 164                  |
| 408               | Scott Arnett No. 1.....    | Metz, 1.7 miles N 10° W of. | 168                  |
| 410               | E. Moore Heirs No. 1.....  | Metz, 2 miles N of.....     | 167                  |
| 418               | Simon Moore No. 1.....     | Metz, 3 miles N of.....     | 167                  |

No. 396 in above table was a Gordon sand oil producer. Had show of oil in Thirty-foot and heavy water in Big Injun.

No. 398 was a Gordon oil producer, with water and show of oil in Big Injun and Thirty-foot.

No. 402 was a Big Injun oil producer.

No. 408 was a Gordon sand oil producer with water in Big Injun.

No. 410 was drilled 15 years ago and had an initial oil production of 3200 bbls. daily, and was still making 3 bbls. daily in August, 1911.

No. 418 had a light show of oil in the Gordon sand. It was drilled on down through the Fourth sand, but no additional oil was encountered.

The **John Styles No. 1 well (409)**, located 2 miles N 10° W of Metz in the main valley of Campbell's run and drilled early in 1897 by the South Penn Oil Company, was the first Gordon oil well in this region. Thereafter the producing horizon was locally known as the "Campbell's Run" sand.

On the southwest slope of the anticlinal bulge south of Glover Gap, mentioned under the description of the Campbell Run oil pool, there are about a dozen Big Injun sand oil wells. The following is a record of one of these wells:

## John Baker No. 4 Well Record (384).

Mannington district, 2.6 miles west of Metz. Authority, South Penn Oil Company.

|   | Thickness. | Total. |
|---|------------|--------|
|   | Feet.      | Feet.  |
| Conductor .....   | 16         | 16     |
| Unrecorded .....  | 1140       | 1156   |
| Mapletown (Sewickley) coal .....  | 4          | 1160   |
| Unrecorded .....  | 96         | 1256   |
| Pittsburgh coal .....   | 7          | 1263   |
| Unrecorded .....  | 1230       | 2493   |
| Big Lime .....  | 73         | 2566   |
| Big Injun sand (oil, 2651'; water, 2655') and unrecorded to bottom .....  | 109        | 2675   |
| 10" casing, 556'; 8 $\frac{1}{4}$ " casing, 1760'; 6 $\frac{1}{2}$ " casing, 2336'; 5 $\frac{7}{8}$ " liner, 2592'. |            |        |

## George Watson No. 1 Well Record (377).

Mannington district, 0.6 mile northeast of Seven Pines. Authority, South Penn Oil Co.

| (Elevation, 1110' B.A.T.)               | Thickness. | Total. |
|---|------------|--------|
|   | Feet.      | Feet.  |
| Conductor .....                         | 16         | 16     |
| Limestone and slate .....               | 434        | 450    |
| Bluff sand .....                        | 40         | 490    |
| Limestone and slate .....               | 280        | 770    |
| Mapletown (Sewickley) coal .....        | 2          | 772    |
| Limestone .....                         | 91         | 863    |
| Pittsburgh coal .....                   | 7          | 870    |
| Slate .....                             | 20         | 890    |
| Limestone .....                         | 100        | 990    |
| Sand .....                              | 40         | 1030   |
| Red rock .....                          | 100        | 1130   |
| Sand, (Moundsville and I Cow Run) ..... | 185        | 1315   |
| Slate .....                             | 28         | 1343   |
| Dunkard sand .....                      | 82         | 1425   |
| Slate .....                             | 25         | 1450   |
| Gas sand .....                          | 275        | 1725   |
| Slate .....                             | 10         | 1735   |
| Salt sand .....                         | 90         | 1825   |
| Slate .....                             | 25         | 1850   |
| Sand (water, 1940') .....               | 90         | 1940   |
| Slate .....                             | 40         | 1980   |
| Sand .....                              | 30         | 2010   |
| Slate and shell .....                   | 80         | 2090   |
| Pencil cave .....                       | 3          | 2093   |
| Big Lime .....                          | 87         | 2180   |
| Black sand .....                        | 3          | 2183   |
| Big Injun sand .....                    | 122        | 2305   |
| Slate and sand .....                    | 465        | 2770   |
| Fifty-foot sand .....                   | 80         | 2850   |
| Slate and shells .....                  | 30         | 2880   |
| Sand, (Thirty-foot) .....               | 40         | 2920   |
| Shells .....                            | 75         | 2995   |

|  | Thickness.                            | Total |
|--|---------------------------------------|-------|
|  | Feet.                                 | Feet. |
| Sand, (Stray) (heavy gas, 2998') .....                                     | 20                                    | 3015  |
| Slate .....  | 3                                     | 3018  |
| Sand .....12'  | } (Gordon) (show of black oil, 3033') | 30    |
| Slate ..... 3  |                                       |       |
| Sand .....15   |                                       |       |
| Slate .....  | 2                                     | 3050  |
| Sand .....   | 20                                    | 3070  |
| Slate, black, to bottom .....  | 18                                    | 3088  |
| 10" casing, 156'; 8½" casing, 1345'; 6½" casing, 1949'; 5½" casing, 2320'. |                                       |       |

Northwest of Logansport and northeastward from Rymer there occurs an oil pool in the Thirty-foot sand consisting of 50 to 60 wells. The five following records are from this region:

### C. S. Pitzer No. 1 Well Record (446).

Mannington district, 1.3 miles N 80° E of Rymer. Authority, South Penn Oil Company. Completed Aug. 20, 1904.

| (Elevation, 1320' B-A.T.)  | Thickness. | Total |
|--|------------|-------|
|  | Feet.      | Feet. |
| Conductor .....  | 16         | 16    |
| Unrecorded .....   | 869        | 885   |
| Mapletown (Sewickley) coal .....   | 5          | 890   |
| Unrecorded .....   | 92         | 982   |
| Pittsburgh coal (steel line measurement) .....                             | 8          | 990   |
| Unrecorded .....   | 1222       | 2212  |
| Big Lime .....   | 80         | 2292  |
| Big Injun sand .....   | 140        | 2432  |
| Unrecorded .....   | 448        | 2880  |
| Fifty-foot sand .....  | 100        | 2980  |
| Unrecorded .....   | 43         | 3023  |
| Thirty-foot sand (oil, 3032') .....  | 26         | 3049  |
| Unrecorded to bottom .....   | 3          | 3052  |
| 10" casing, 260'; 8½" casing, 1477'; 6½" casing, 2137'; 5½" casing, 2574'. |            |       |

Shot Sept. 7, 1904, with 8 quarts; top, 3031'.  
 Shot Sept. 22, 1904, with 16 quarts; top, 3030'.  
 Shot Oct. 14, 1904, with 20 quarts; top, 3030'.  
 Shot Jan. 14, 1905, with 40 quarts; top, 3030'.  
 Shot May 15, 1905, with 60 quarts; top, 3030'.  
 Shot June 2, 1905, with 100 quarts; top, 3029'.  
 Shot Oct. 28, 1905, with 30 quarts; top, 3029'.  
 Shot Jan. 20, 1906, with 140 quarts; top, 3030'.

### C. S. Pitzer No. 2 Well Record (444).

Mannington district, 1.3 miles northeast of Rymer. Authority, South Penn Oil Company. Completed Nov. 15, 1904.

| (Elevation, 1450' B-A.T.)                      | Thickness. | Total |
|--|------------|-------|
|  | Feet.      | Feet. |
| Conductor .....                                | 5          | 5     |
| Unrecorded .....                               | 1015       | 1020  |
| Pittsburgh coal (steel line measurement) ..... |            | 1020  |

|  | Thickness. | Total. |
|--|------------|--------|
|  | Feet.      | Feet.  |
| Unrecorded .....   | 1005       | 2025   |
| Second Salt sand (water, 10 ballers, 2035'; 4 ballers, 2055') ..   | 60         | 2085   |
| Unrecorded .....   | 280        | 2365   |
| Big Lime .....   | 80         | 2445   |
| Big Injun sand .....   | 145        | 2590   |
| Unrecorded .....   | 470        | 3060   |
| Fifty-foot sand (gas, 12/10 mercury; steel line measurement) .....   | 68         | 3128   |
| Unrecorded .....   | 34         | 3162   |
| Thirty-foot sand (oil, 3176') and unrecorded to bottom....   | 25         | 3187   |
| 10" casing, 260'; 8 $\frac{1}{2}$ " casing, 1608'5"; 6 $\frac{5}{8}$ " casing, 2120'6"; 5 $\frac{1}{8}$ " casing, 2623'3". |            |        |
| Nov. 28, 1904, shot with 8 quarts; top, 3176'.   |            |        |
| Dec. 8, 1904, shot with 12 quarts; top, 3175'.   |            |        |
| Dec. 21, 1904, shot with 30 quarts; top, 3174'.  |            |        |
| Jan. 2, 1905, shot with 40 quarts; top, 3176'.   |            |        |
| Jan. 12, 1905, shot with 60 quarts; top, 3186'.  |            |        |
| Feb. 15, 1905, shot with 50 quarts; top, 3187'.  |            |        |
| Mar. 9, 1905, shot with 70 quarts; top, 3189'.   |            |        |
| Apr. 4, 1905, shot with 90 quarts; top, 3176'.   |            |        |
| May 1, 1905, shot with 100 quarts; top, 3176'.   |            |        |
| June 20, 1905, shot with 120 quarts; top, 3176'.   |            |        |

### J. L. Beatty No. 1 Well Record (447).

Mannington district, 1.2 miles north of Logansport. Authority  
South Penn Oil Company. Completed in 1897.

| (Elevation, 1130' B.A.T.)           | Thickness. | Total. |
|-------------------------------------|------------|--------|
|                                     | Feet.      | Feet.  |
| Conductor .....                     | 14         | 14     |
| Lime and slate .....                | 664        | 678    |
| Mapletown (Sewickley) coal .....    | 5          | 683    |
| Unrecorded .....                    | 91         | 774    |
| Pittsburgh coal .....               | 10         | 784    |
| Slate and lime .....                | 16         | 800    |
| Lime and sand .....                 | 20         | 820    |
| Slate and red rock .....            | 20         | 840    |
| Unrecorded .....                    | 100        | 940    |
| Sand .....                          | 20         | 960    |
| Red rock and lime .....             | 210        | 1170   |
| Sand .....                          | 15         | 1185   |
| Red rock .....                      | 45         | 1230   |
| Little Dunkard sand .....           | 30         | 1260   |
| Lime .....                          | 30         | 1290   |
| Sand .....                          | 110        | 1400   |
| Sand and lime (water, 1560') .....  | 275        | 1675   |
| Salt sand (gas, 1690') .....        | 175        | 1850   |
| Lime and shells .....               | 175        | 2025   |
| Big Lime .....                      | 83         | 2108   |
| Big Injun sand (water, 2188') ..... | 132        | 2240   |
| Lime and sand .....                 | 30         | 2270   |
| Slate and lime .....                | 100        | 2370   |
| Sand .....                          | 70         | 2440   |
| Lime .....                          | 280        | 2720   |
| Fifty-foot sand .....               | 60         | 2780   |

|  | Thickness.<br>Feet. | Total.<br>Feet. |
|--|---------------------|-----------------|
| Slate and lime .....   | 25                  | 2805            |
| Sand, (Thirty-foot) (gas, 2807'; oil, 2813'-2817'; steel line measurement) ..... | 35                  | 2840            |
| Red rock .....   | 10                  | 2850            |
| Lime .....   | 20                  | 2870            |
| Slate and shell.....   | 63                  | 2933            |
| Sand (Gordon) (white pebbles; gas, 2941').....                                   | 30                  | 2963            |
| Slate and shell.....   | 10                  | 2973            |
| Gray sand (Gordon) .....   | 20                  | 2993            |
| Slate and shell.....   | 49                  | 3042            |
| Gray sand, (Fourth) .....  | 15                  | 3057            |
| Slate and shell to bottom.....   | 54                  | 3111            |
| 10" casing, 148'; 8¼" casing, 1272'; 6½" casing, 2045'.                          |                     |                 |
| Shot Apr. 6, 1905, with 30 quarts; top, 2813'.                                   |                     |                 |
| Shot June 9, 1905, with 50 quarts; top, 2813'.                                   |                     |                 |
| Shot July 24, 1905, with 60 quarts; top, 2813'.                                  |                     |                 |
| Shot Aug. 22, 1905, with 70 quarts; top, 2813'.                                  |                     |                 |
| Shot Dec. 6, 1905, with 80 quarts; top, 2813'.                                   |                     |                 |

### A. J. Hayes No. 8 Well Record (448).

Mannington district, 1.1 miles northeast of Rymer. Authority, Delmar Oil Company.

| (Elevation, 1300' B.A.T.)        | Thickness.<br>Feet. | Total.<br>Feet. |
|----------------------------------|---------------------|-----------------|
| Unrecorded .....                 | 510                 | 510             |
| Coal, native (Washington).....   | 10                  | 520             |
| Unrecorded .....                 | 390                 | 910             |
| Coal, Mapletown (Sewickley)..... | 7                   | 917             |
| Unrecorded .....                 | 90                  | 1007            |
| Coal, Pittsburgh.....            | 9                   | 1016            |
| Unrecorded .....                 | 191                 | 1207            |
| Murphy sand.....                 | 20                  | 1227            |
| Unrecorded .....                 | 180                 | 1407            |
| Little Dunkard sand.....         | 20                  | 1427            |
| Unrecorded .....                 | 90                  | 1517            |
| Big Dunkard sand.....            | 30                  | 1547            |
| Unrecorded .....                 | 160                 | 1707            |
| Gas sand.....                    | 50                  | 1757            |
| Unrecorded .....                 | 25                  | 1782            |
| Salt sand.....                   | 298                 | 2080            |
| Unrecorded .....                 | 77                  | 2157            |
| Maxton sand.....                 | 30                  | 2187            |
| Unrecorded .....                 | 33                  | 2220            |
| Little Lime.....                 | 23                  | 2243            |
| Pencil cave.....                 | 10                  | 2253            |
| Big Lime.....                    | 90                  | 2343            |
| Big Injun sand.....              | 111                 | 2454            |
| Unrecorded .....                 | 356                 | 2810            |
| Berea sand.....                  | 45                  | 2855            |
| Unrecorded .....                 | 75                  | 2930            |
| Fifty-foot sand.....             | 55                  | 2985            |
| Unrecorded .....                 | 15                  | 3000            |
| Sand .....                       | 15                  | 3015            |

|  | Thickness. | Total. |
|--|------------|--------|
|  | Feet.      | Feet.  |
| Unrecorded .....                       | 5          | 3020   |
| Thirty-foot sand.....                  | 4          | 3024   |
| Unrecorded to bottom (oil, 3026')..... | 13         | 3037   |

### A. J. Hayes No. 13 Well Record (453).

Mannington district, 0.7 mile N 80° E of Rymer. Authority, Delmar Oil Company.

| (Elevation, 1025' B-A.T.)          | Thickness. | Total. |
|------------------------------------|------------|--------|
|                                    | Feet.      | Feet.  |
| Unrecorded .....                   | 628        | 628    |
| Coal, Mapletown (Sewickley).....   | 5          | 633    |
| Unrecorded .....                   | 77         | 710    |
| Pittsburgh coal.....               | 8          | 718    |
| Unrecorded .....                   | 1237       | 1955   |
| Big Lime.....                      | 85         | 2040   |
| Big Injun sand.....                | 115        | 2155   |
| Unrecorded .....                   | 375        | 2530   |
| Sand, (Berea).....                 | 50         | 2580   |
| Unrecorded .....                   | 70         | 2650   |
| Gantz sand.....                    | 10         | 2660   |
| Unrecorded .....                   | 10¼        | 2670   |
| Fifty-foot sand.....               | 38         | 2708   |
| Unrecorded .....                   | 12         | 2720   |
| Thirty-foot sand (oil, 2730')..... | 21         | 2741   |
| Unrecorded .....                   | 17         | 2758   |
| Gordon Stray sand.....             | 15         | 2773   |
| Unrecorded .....                   | 65         | 2838   |
| Gordon sand (gas, 2853').....      | 30         | 2868   |

The **Geo. Beatty No. 3 well (457)**, located 0.5 mile north-east of Logansport, made 1 to 1½ million cubic feet of gas daily from the Gordon sand, with a rock pressure of 650 lbs. to the square inch; and **No. 1 (458)** on the same farm had an initial oil production of 30 to 40 barrels daily from the Thirty-foot sand.

On the waters of Laurel run, immediately northwest of Curtisville, there occurs a small gas pool of one-half dozen wells. The following record from one of the wells shows that the Gordon and Fourth sands are the producing horizons:

### Jonathan Arnett No. 1 Well Record (460).

Mannington district, 0.5 mile northwest of Curtisville. Authority, Carnegie Natural Gas Company. Completed August, 1908.

| (Elevation, 1055' B-A.T.)        | Thickness. | Total. |
|----------------------------------|------------|--------|
|                                  | Feet.      | Feet.  |
| Unrecorded .....                 | 714        | 714    |
| Coal, Mapletown (Sewickley)..... |            | 714    |

|  | Thickness.<br>Feet. | Total.<br>Feet. |
|--|---------------------|-----------------|
| Unrecorded .....   | 104                 | 818             |
| Coal, Pittsburgh.....  |                     | 818             |
| Unrecorded .....   | 1327                | 2145            |
| Big Injun sand.....  | 120                 | 2265            |
| Unrecorded .....   | 435                 | 2700            |
| Fifty-foot sand.....   | 55                  | 2755            |
| Unrecorded (hole reduced to 5- $\frac{1}{8}$ " at 2900').....                              | 173                 | 2928            |
| Gordon sand (gas, 2931').....  | 3                   | 2931            |
| Unrecorded .....   | 35                  | 2966            |
| Fourth sand (little gas, 2970').....   | 30                  | 2996            |
| Unrecorded to bottom.....  | 2                   | 2998            |
| 18" casing, 155'; 8 $\frac{1}{4}$ " casing, 1270'; 6-5/8" casing, 2105'; 3" tubing, 2959'. |                     |                 |

The following record of a well abandoned as non-paying, located 1.5 miles southward from the gas pool last mentioned, gives interesting data as to the coals of the Monongahela series as well as the horizons in which oil and gas shows were encountered:

#### Alexander Huey No. 1 Well Record (469).

Mannington district, 1.3 miles south of Curtisville. Authority, Delmar Oil Company.

|   | Thickness.<br>Feet. | Total.<br>Feet. |
|---|---------------------|-----------------|
| Unrecorded .....                        | 161                 | 161             |
| Coal, native.....                       | 5                   | 166             |
| Unrecorded .....                        | 276                 | 442             |
| Coal, (Waynesburg).....                 | 11                  | 453             |
| Unrecorded .....                        | 269                 | 722             |
| Coal, Mapletown (Sewickley).....        | 8                   | 730             |
| Unrecorded .....                        | 85                  | 815             |
| Pittsburgh coal (very broken).....      | 6                   | 821             |
| Unrecorded .....                        | 1212                | 2033            |
| Maxton sand (oil, 2041').....           | 10                  | 2043            |
| Unrecorded .....                        | 139                 | 2182            |
| Big Injun sand.....                     | 112                 | 2294            |
| Unrecorded .....                        | 511                 | 2805            |
| Fifty-foot sand (gas, 2830').....       | 50                  | 2855            |
| Unrecorded .....                        | 5                   | 2860            |
| Thirty-foot sand (oil show, 2870')..... | 36                  | 2896            |
| Unrecorded .....                        | 19                  | 2915            |
| Gordon Stray sand.....                  | 27                  | 2942            |
| Unrecorded .....                        | 30                  | 2972            |
| Gordon sand (badly broken).....         | 36                  | 3008            |
| Slaty shale to bottom.....              | 309                 | 3317            |

Two miles southward from Logansport there occurs a small oil pool on the waters of Tucker fork and Coal Lick run. The three following records from wells therein, contain much data of interest and show the oil horizons to be the Maxton, Thirty-foot and Gordon sands:

**M. W. Huey Heirs No. 1 Well Record (471).**

Mannington district, 2.4 miles northwest of Pleasantville. Authority, South Penn Oil Company. Completed January 30, 1907.

| (Elevation, 1320' B-A.T.)   | Thickness. Total |       |
|---|------------------|-------|
|   | Feet.            | Feet. |
| Conductor .....   | 16               | 16    |
| Unrecorded .....  | 844              | 860   |
| Mapletown (Sewickley) coal.....   | 5                | 865   |
| Unrecorded .....  | 90               | 955   |
| Pittsburgh coal (steel line measurement).....                                 | 10               | 965   |
| Unrecorded .....  | 753              | 1718  |
| Second gas sand (water, 1745').....   | 37               | 1755  |
| Unrecorded .....  | 350              | 2105  |
| Maxton sand.....  | 85               | 2190  |
| Pencil cave.....  | 5                | 2195  |
| Big Lime.....   | 79               | 2274  |
| Big Injun sand (gas, 2345'; water, 2364').....                                | 136              | 2410  |
| Unrecorded .....  | 440              | 2850  |
| Gantz sand.....   | 20               | 2870  |
| Unrecorded .....  | 10               | 2880  |
| Fifty-foot sand.....  | 35               | 3915  |
| Unrecorded .....  | 35               | 3950  |
| Thirty-foot sand (oil, 2960') (steel line measurement)....                    | 28               | 2978  |
| Unrecorded .....  | 123              | 3101  |
| Gordon sand (oil, 3108') and unrecorded to bottom.....                        | 21               | 3122  |
| 10" casing, 185'; 8¼" casing, 1462'; 6¾" casing, 2236'; 5 7/8" casing, 2412'. |                  |       |

**J. A. Harbert No. 1 Well Record (472).**

Mannington district, 2.4 miles northwest of Pleasantville. Authority, South Penn Oil Company. Completed June 26, 1909.

| (Elevation, 1085' B-A.T.)   | Thickness. Total |       |
|---|------------------|-------|
|   | Feet.            | Feet. |
| Conductor .....   | 16               | 16    |
| Unrecorded .....  | 614              | 630   |
| Mapletown (Sewickley) coal.....                                       | 4                | 634   |
| Unrecorded .....  | 100              | 734   |
| Pittsburgh coal.....  | 5                | 739   |
| Unrecorded .....  | 851              | 1590  |
| Sand (water, 1595').....  | 50               | 1640  |
| Unrecorded .....  | 85               | 1725  |
| Salt sand.....  | 70               | 1795  |
| Unrecorded .....  | 90               | 1885  |
| Maxton sand (oil, 1891').....   | 32               | 1917  |
| Unrecorded to bottom.....   | 26½              | 1943½ |
| 10" casing, 352'; 8¼" casing, 1250'; 6¾" casing, 1659'8".             |                  |       |
| Shot June 29, 1909, with 20 quarts; 5" x 4'10" shell; top, 1881'.     |                  |       |
| Shot June 30, 1909, with 20 quarts; 5" x 4'10-7/8" shell; top, 1891'. |                  |       |



**George A. Huey No. 1 Well Record (472A).**

Mannington district, 2.5 miles northwest of Pleasantville. Authority, South Penn Oil Company. Completed June 29, 1907.

| (Elevation, 1350' B-A.T.)  | Thickness. Total. |       |
|--|-------------------|-------|
|  | Feet.             | Feet. |
| Conductor .....  | 16                | 16    |
| Unrecorded .....   | 854               | 870   |
| Mapletown (Sewickley) coal.....  | ...               | 870   |
| Unrecorded .....   | 102               | 972   |
| Pittsburgh coal (steel line measurement).....  | 5                 | 977   |
| Unrecorded .....   | 1183              | 2160  |
| Maxton sand .....  | 85                | 2245  |
| Big Lime (steel line measurement) .....  | 55                | 2300  |
| Big Injun sand (water, 2382') .....  | 120               | 2420  |
| Unrecorded .....   | 487               | 2907  |
| Fifty-foot sand.....   | 43                | 2950  |
| Unrecorded .....   | 26                | 2976  |
| Thirty-foot sand (oil show, 2991') (steel line measurement) .....  | 20                | 2996  |
| Unrecorded .....   | 98                | 3094  |
| Gordon Stray sand (steel line measurement).....  | 17                | 3111  |
| Unrecorded .....   | 10                | 3121  |
| Gordon sand (gas, 3126'; oil, 3130') and unrecorded to bottom (steel line measurement).....                          | 25                | 3146  |
| 10" casing, 193'; 8 $\frac{1}{4}$ " casing, 1504'; 6 $\frac{5}{8}$ " casing, 2271'; 5 $\frac{3}{8}$ " casing, 2440'. |                   |       |

Shot June 27, 1907, with 30 quarts; 11"6" x 4" shell, top, 3129'.

The following is the record of a non-paying well drilled 1 mile southwestward from the last boring mentioned:

**Daniel F. Heldreth No. 1 Well Record (474).**

Mannington district, 2.1 miles northwest of Margaret. Authority, Chartiers Oil Company. Completed Feb. 5, 1910.

| (Elevation, 1145' B-A.T.)  | Thickness. Total. |                    |
|--|-------------------|--------------------|
|  | Feet.             | Feet.              |
| Unrecorded .....   | 940               | 940                |
| Pittsburgh coal .....  | ...               | 940                |
| Unrecorded .....   | 1282              | 2222               |
| Big Injun sand (little oil, and hole full of water, 2320')..   | 138               | 2360               |
| Unrecorded .....   | 691               | 3051               |
| Gordon sand (gas, 3053'; gas and oil show, 3076').....   | 38                | 3089               |
| Slate and shells to bottom.....  | 653 $\frac{1}{2}$ | 3742 $\frac{1}{2}$ |
| 10" casing, 163'; 8 $\frac{1}{4}$ " casing, 1361'; 6 $\frac{5}{8}$ " casing, 2344'; 5 $\frac{3}{8}$ " casing, 2913'. |                   |                    |

"After standing 4 days hole filled up 150 feet with oil."

In the extreme southwest corner of Mannington district, Marion county, there occurs a very rich oil pool on the waters of Quaker fork, consisting of about 60 wells, the Gordon Stray and Gordon sands being the producing horizons. The wells had an initial oil production ranging from 10 to 500 barrels

daily, the latter sand being the most prolific. The pool conforms ideally with the anticlinal theory of the accumulation of oil and gas, in that it lies down near the low point of the Robinson synclinal basin, since the Stray and Gordon sands are both non-water bearing in this portion of the State. The five following records of wells therein give much data of interest for this region:

#### A. J. Ice, Jr., No. 1 Well Record (486).

Mannington district, 2 miles N 80° W of Margaret. Authority, Delmar Oil Company.

|                                     | Thickness. | Total. |
|-------------------------------------|------------|--------|
|                                     | Feet.      | Feet.  |
| (Elevation, 1135' B-A.T.)           |            |        |
| Unrecorded .....                    | 1020       | 1020   |
| Pittsburgh coal.....                | ...        | 1020   |
| Unrecorded .....                    | 1230       | 2250   |
| Big Lime .....                      | 60         | 2310   |
| Big Injun sand.....                 | 105        | 2415   |
| Unrecorded .....                    | 661        | 3076   |
| Gordon Stray sand (oil, 3079')..... | 15         | 3091   |
| Unrecorded .....                    | 14         | 3105   |
| Gordon sand (oil, 3122').....       | 34         | 3139   |
| Unrecorded to bottom.....           | 4          | 3143   |
| "460 barrel well, best in field."   |            |        |

#### Joshua Looman No. 1 Well Record (482).

Mannington district, 2.1 miles northwest of Margaret. Authority, Delmar Oil Company.

|  | Thickness. | Total. |
|--|------------|--------|
|  | Feet.      | Feet.  |
| Unrecorded .....                               | 1053       | 1053   |
| Pittsburgh coal.....                           | 10         | 1063   |
| Unrecorded .....                               | 1207       | 2270   |
| Big Lime.....                                  | 56         | 2326   |
| Big Injun sand (gas, 2350'; water, 2419')..... | 161        | 2487   |
| Unrecorded .....                               | 418        | 2905   |
| Gantz sand.....                                | 39         | 2944   |
| Unrecorded .....                               | 11         | 2955   |
| Fifty-foot sand.....                           | 93         | 3048   |
| Unrecorded .....                               | 82         | 3130   |
| Gordon sand (oil, 3138').....                  | 34         | 3164   |

#### B. F. Robinson No. 4 Well Record (483).

Mannington district, 1.5 miles north of Alliance. Authority, Delmar Oil Company.

|                      | Thickness. | Total. |
|----------------------|------------|--------|
|                      | Feet.      | Feet.  |
| Unrecorded .....     | 1225       | 1225   |
| Pittsburgh coal..... | 6          | 1231   |

|   | Thickness. | Total. |
|---|------------|--------|
|   | Feet.      | Feet.  |
| Unrecorded .....  | 319        | 1550   |
| Little Dunkard sand .....   | 15         | 1565   |
| Unrecorded .....  | 135        | 1700   |
| Big Dunkard sand .....  | 45         | 1745   |
| Unrecorded .....  | 45         | 1790   |
| Gas sand .....  | 95         | 1885   |
| Unrecorded .....  | 65         | 1950   |
| Salt sand .....   | 245        | 2195   |
| Unrecorded .....  | 255        | 2450   |
| Pencil cave .....   | 5          | 2455   |
| Big Lime .....  | 46         | 2501   |
| Big Injun sand .....  | 154        | 2655   |
| Unrecorded .....  | 67         | 2722   |
| Squaw sand .....  | 40         | 2762   |
| Unrecorded .....  | 327        | 3089   |
| Gantz and Fifty-foot sand (oil and gas, 3094'; salt water, 3127') ..... | 102        | 3191   |
| Unrecorded .....  | 9          | 3200   |
| Thirty-foot sand .....  | 20         | 3220   |
| Unrecorded .....  | 5          | 3225   |
| Stray sand .....  | 53         | 3278   |
| Unrecorded .....  | 2          | 3280   |
| Stray sand .....  | 18         | 3298   |
| Unrecorded .....  | 13         | 3311   |
| Gordon sand .....   | 27         | 3338   |
| Unrecorded to bottom .....  | 37         | 3375   |

The above well was apparently dry in both the Stray and Gordon sands, but had oil and gas in the Gantz. The pay of salt water in the Fifty-foot is unusual in the three counties.

#### Mary E. Price No. 1 Well Record (484).

Mannington district, 1.5 miles N 25° W of Alliance. Authority, Delmar Oil Company.

|  | Thickness. | Total. |
|--|------------|--------|
| (Elevation, 1200' B-A.T.)                    | Feet.      | Feet.  |
| Unrecorded .....                             | 1105       | 1105   |
| Pittsburgh coal .....                        | 6          | 1111   |
| Unrecorded .....                             | 1284       | 2395   |
| Big Injun sand .....                         | 85         | 2480   |
| Unrecorded .....                             | 674        | 3154   |
| Gordon Stray sand (oil and gas, 3160') ..... | 26         | 3180   |
| Unrecorded .....                             | 6          | 3186   |
| Gordon sand and unrecorded to bottom .....   | 24         | 3210   |

#### Jesse Talkington No. 1 Well Record (475).

Mannington district, 1.5 miles northwest of Margaret. Authority, Delmar Oil Company. Commenced March 8, 1900.

|                           | Thickness. | Total. |
|---------------------------|------------|--------|
| (Elevation, 1085' B-A.T.) | Feet.      | Feet.  |
| Unrecorded .....          | 823        | 823    |
| Pittsburgh coal .....     | 9          | 832    |

|   | Thickness. | Total. |
|---|------------|--------|
|   | Feet.      | Feet.  |
| Unrecorded .....                            | 1205       | 2037   |
| Dunkard sand and unrecorded.....            | 189        | 1410   |
| Gas sand.....                               | 100        | 1510   |
| Unrecorded .....                            | 70         | 1580   |
| Salt sand.....                              | 314        | 1894   |
| Unrecorded .....                            | 143        | 2037   |
| Big Lime.....                               | 70         | 2107   |
| Big Injun sand.....                         | 130        | 2237   |
| Unrecorded .....                            | 478        | 2715   |
| Gantz and Fifty-foot sand (gas, 2747')..... | 99         | 2814   |
| Unrecorded .....                            | 124        | 2938   |
| Gordon sand (oil and gas, 2953').....       | 32         | 2970   |
| Shells to bottom.....                       | 354        | 3324   |

"Five feet of good loose sand in Gordon."

10" casing, 179'; 8 $\frac{1}{4}$ " casing, 1237'; 6 $\frac{1}{2}$ " casing, 2128'; 5 $\frac{1}{8}$ " casing, 2270', on wall packer.

The following is the record of the well mentioned on page 390 under the description of the Moundsville sand, in which the gas pay evidently occurs in the latter formation. The boring stopped 300 to 400 feet above the top of the Big Injun sand:

#### A. H. Heldreth No. 1 Well Record (478).

Mannington district, 0.5 mile northwest of Margaret. Authority, Delmar Oil Company.

|   | Thickness. | Total. |
|---|------------|--------|
|   | Feet.      | Feet.  |
| (Elevation, 1050' B-A.T.)                             |            |        |
| Unrecorded .....                                      | 660        | 660    |
| Pittsburgh coal.....                                  | 9          | 669    |
| Unrecorded .....                                      | 321        | 990    |
| Sand, Little Dunkard? (Moundsville) (gas, 1000')..... | 28         | 1018   |
| Unrecorded .....                                      | 62         | 1080   |
| Big Dunkard sand.....                                 | 55         | 1145   |
| Unrecorded .....                                      | 155        | 1300   |
| Gas sand.....   | 25         | 1325   |
| Unrecorded .....                                      | 205        | 1530   |
| Salt sand.....  | 30         | 1560   |
| Unrecorded to bottom.....                             | 47         | 1607   |

**Flat Run Oil Pool.**—What is known as the Flat Run oil pool is that belt of wells extending southwestward along the waters of Flat run and Pyle's fork to the north edge of Mannington, the whole containing about 125 producing wells, the initial production of which ranged from 5 to over 3000 barrels daily from the Fourth and Big Injun sands. The **J. A. Thomas No. 1 well (429)**, located 0.2 mile north of Condit on Flat run and completed in 1894 by the South Penn Oil Company, was the first well drilled in this pool in searching for its exten-

sion northward from Mannington. The detailed record of this well is published on pages 245-246 of Vol. I of the State Survey reports. The oil pay occurs in the Fourth sand, the top of which comes 2227 feet below the Pittsburgh coal. This well has produced an enormous amount of oil, since it started off at 3100 barrels daily in 1894 and was still making 3 to 4 barrels daily in August, 1911.

In addition to the brief logs of the list of wells below from the Flat Run oil pool the more complete records of the same are given on the pages indicated of Vol. I(A) of the State Survey reports, to which the reader is referred for coal data and general information concerning the rock succession.

| No. on<br>Map II. | Name of Well.            | Location.                 | Page of<br>Vol. I(A) |
|-------------------|--------------------------|---------------------------|----------------------|
| 426               | Sanford Toothman No. 1   | Galletin, 1.4 miles SW of | 170                  |
| 427               | W. R. Dickens No. 1...   | Condit, 1.5 miles NE of.  | 171                  |
| 428               | Mike Snyder No. 2.....   | Condit, 0.4 mile N of.... | 172                  |
| 432               | E. J. Freeland No. 1.... | Condit, 0.5 mile W of...  | 166                  |
| 493               | Nimrod Morgan No. 7...   | Mannington, 0.9 mile N of | 163                  |
| 494               | Nimrod Morgan No. 5...   | Mannington, 0.8 mile N of | 163                  |
| 495               | Paddy Hopkins No. 2...   | Mannington, 0.7 mile N of | 159                  |
| 496               | Paddy Hopkins No. 1...   | Mannington, 0.6 mile N of | 159                  |

No. 426 above was a Fourth sand oil producer with oil show in the Big Injun and Gantz sands.

No. 427 was a 15-barrel oil producer from the Fourth sand, with a show of oil in the Big Injun.

No. 428 was an oil producer from the Big Injun and Fourth.

No. 432 was an oil producer from the Big Injun and Fifth, with a gas pay in the Fifty-foot.

No. 493 was a Fourth sand oil well with a Big Injun gas pay.

No. 494 was a Fourth sand oil well.

No. 495 was a Fourth sand oil well.

No. 496 was a Fourth sand oil well with gas in Gantz and Fifty-foot.

The eight following records are from wells scattered throughout the Flat Run oil belt from Galletin southwestward to Drake's run of Pyle's fork:

### John W. Grubb No. 2 Well Record (425).

Mannington district, 0.9 mile southwest of Galletin. Authority, South Penn Oil Company. Completed June 19, 1897.

|                           | Thickness. | Total |
|---------------------------|------------|-------|
| (Elevation, 1109' L.A.T.) | Feet.      | Feet. |
| Unrecorded .....          | 800        | 800   |
| Pittsburgh coal.....      | .....      | 800   |

|   | Thickness. | Total. |
|---|------------|--------|
|   | Feet.      | Feet.  |
| Unrecorded .....  | 800        | 1700   |
| Salt sand (water, 1840') .....                          | 140        | 1840   |
| Unrecorded .....  | 160        | 2000   |
| Big Lime (cave, 2030') .....                            | 70         | 2070   |
| Big Injun sand .....                                    | 140        | 2210   |
| Sand, hard, Big Injun (oil, gas and water, 2190') ..... | 70         | 2280   |
| Unrecorded .....  | 716        | 2996   |
| Fourth sand (oil pay, 2996') .....                      | 32         | 3028   |
| Unrecorded to bottom .....                              | 2          | 3030   |

**Mike Snyder No. 2 Well Record (428).**

Mannington district, 0.5 mile north of Condit. Authority, South Penn Oil Company. Completed Sept. 13, 1895.

|   | Thickness. | Total. |
|---|------------|--------|
|   | Feet.      | Feet.  |
| (Elevation, 1174' L-A.T.)   |            |        |
| Conductor .....   | 18         | 18     |
| Unrecorded .....  | 792        | 810    |
| Pittsburgh coal .....   | ...        | 810    |
| Unrecorded .....  | 533        | 1343   |
| Dunkard sand .....  | 70         | 1413   |
| Unrecorded .....  | 62         | 1475   |
| Gas sand .....  | 65         | 1540   |
| Unrecorded .....  | 270        | 1810   |
| Salt sand .....   | 110        | 1920   |
| Unrecorded .....  | 90         | 2010   |
| Pencil cave .....   | 6          | 2016   |
| Big Lime .....  | 121        | 2137   |
| Big Injun sand (oil, 2211') .....   | 133        | 2270   |
| Unrecorded .....  | 440        | 2710   |
| Gantz sand .....  | 45         | 2755   |
| Unrecorded .....  | 15         | 2770   |
| Fifty-foot sand .....   | 35         | 2805   |
| Unrecorded .....  | 20         | 2825   |
| Thirty-foot sand and unrecorded .....   | 145        | 2970   |
| Sand, (Gordon) .....  | 55         | 3025   |
| Unrecorded .....  | 7½         | 3032½  |
| Sand, (Fourth) (oil, 3044' and 3060') and unrecorded to bottom .....                            | 31½        | 3064   |
| 10" casing, 330'; 8¼" casing, 1362'; 6½" casing, 2116'; 5½" casing, 2261'; 4¼"x4" casing, 774'. |            |        |
| Shot June 28, 1900, with 30 quarts; 15' shell, top, 3045'.                                      |            |        |
| Shot Oct. 31, 1900, with 30 quarts; 15' shell, top, 3044'.                                      |            |        |

**Isaac F. Thomas No. 1 Well Record (423).**

Mannington district, 1.5 miles southwest of Galletin. Authority, South Penn Oil Company. Completed about 17 years ago.

|                                   | Thickness. | Total. |
|-----------------------------------|------------|--------|
|                                   | Feet.      | Feet.  |
| (Elevation, 1075' B-A.T.)         |            |        |
| Unrecorded .....                  | 320        | 320    |
| Bluff sand and unrecorded .....   | 380        | 700    |
| Coal, Mapletown (Sewickley) ..... | ...        | 700    |
| Unrecorded .....                  | 90         | 790    |

|  | Thickness. | Total. |
|--|------------|--------|
|  | Feet.      | Feet.  |
| Coal, Pittsburgh.....  | 790        | 790    |
| Unrecorded .....   | 1276       | 2066   |
| Big Injun sand (gas, 2110'; oil show, 2183'; water, 2190')..               | 189        | 2255   |
| Unrecorded .....   | 475        | 2730   |
| Fifty-foot sand.....   | 90         | 2820   |
| Red rock and shell.....  | 155        | 2975   |
| Gordon sand.....   | 15         | 2990   |
| Unrecorded .....   | 15         | 3005   |
| Gordon sand.....   | 7          | 3012   |
| Shales .....   | 38         | 3050   |
| Sand, hard, (Fourth).....  | 12         | 3062   |
| Slate and shell to bottom.....   | 134        | 3196   |
| 10" casing, 460'; 8¼" casing, 1340'; 6½" casing, 2040'; 5½" casing, 2185'. |            |        |

The above was considered a dry hole and is located northwest down the structural slope 0.5 mile from the west edge of the Flat run oil belt.

#### Ash Fluharty No. 1 Well Record (431).

Mannington district at Condit. Authority, South Penn Oil Company. Completed Feb. 7, 1903.

|   | Thickness. | Total. |
|---|------------|--------|
| (Elevation, 1000' L-A.T.)                                 | Feet.      | Feet.  |
| Unrecorded .....  | 506        | 506    |
| Coal, Mapletown (Sewickley).....                          |            | 506    |
| Unrecorded .....  | 101        | 607    |
| Coal, Pittsburgh.....                                     |            | 607    |
| Unrecorded .....  | 1260       | 1867   |
| Pencil cave.....  | 5          | 1872   |
| Big Lime.....   | 61         | 1933   |
| Big Injun sand (oil, 2031') and unrecorded to bottom..... | 121        | 2054   |

The above well had an initial oil production of 60 bbls. daily from the Big Injun, and was making 6 bbls. weekly in August, 1911.

#### C. W. Bayles No. 1 Well Record (433).

Mannington district, 1.2 miles southeast of Metz. Authority, South Penn Oil Company. Completed July 22, 1894.

|   | Thickness. | Total. |
|---|------------|--------|
| (Elevation, 1000' B-A.T.)                     | Feet.      | Feet.  |
| Conductor .....                               | 17         | 17     |
| Unrecorded .....                              | 600        | 617    |
| Pittsburgh coal.....                          | 10         | 627    |
| Unrecorded .....                              | 510        | 1137   |
| Dunkard sand and unrecorded.....              | 793        | 1930   |
| Big Injun sand (oil and gas show, 2040')..... | 120        | 2050   |

|  | Thickness.<br>Feet. | Total.<br>Feet. |
|--|---------------------|-----------------|
| Unrecorded .....   | 450                 | 2500            |
| Gantz sand.....  | 70                  | 2570            |
| Slate .....  | 10                  | 2580            |
| Fifty-foot sand (gas, 2580').....  | 20                  | 2600            |
| Unrecorded .....   | 107                 | 2707            |
| Sand, (Stray).....   | 30                  | 2737            |
| Slate .....  | 12                  | 2749            |
| Unrecorded .....   | 30                  | 2779            |
| Sand, (Gordon).....  | 34                  | 2813            |
| Slate .....  | 2                   | 2815            |
| Sand, (Fourth) (oil, 2831') .....  | 27                  | 2842            |
| Unrecorded .....   | 3                   | 2845            |
| Hard sand (Fourth).....  | 19                  | 2864            |
| Soft sand (Fourth).....  | 10                  | 2874            |
| Slate .....  | 8                   | 2882            |
| Hard white sand (Fourth).....  | 8                   | 2890            |
| Slate and shells to bottom.....  | 9                   | 2899            |
| 10" casing, 248'; 8¼" casing, 1137'; 6½" casing, 1736'; 5½" casing, 380'; 4¼"x4" casing, 769'9".     |                     |                 |
| Shot Aug. 6, 1894, with 1½ quarts; Jan. 21, 1895, with 4 quarts; and Sept. 21, 1903, with 16 quarts. |                     |                 |

**Frank O. Price No. 1 Well Record (437).**

Mannington district, 1.4 miles S 10° E of Metz. Authority, South Penn Oil Company. Completed June 1, 1898.

| (Elevation, 1050' B-A.T.)   | Thickness.<br>Feet. | Total.<br>Feet. |
|---|---------------------|-----------------|
| Conductor .....   | 16                  | 16              |
| Unrecorded .....  | 545                 | 561             |
| Coal, Mapletown (Sewickley).....  |                     | 561             |
| Unrecorded .....  | 100                 | 661             |
| Coal, Pittsburgh .....  |                     | 661             |
| Unrecorded .....  | 1339                | 2000            |
| Big Injun sand.....   | 120                 | 2120            |
| Unrecorded .....  | 480                 | 2600            |
| Gantz sand.....   | 15                  | 2615            |
| Unrecorded .....  | 5                   | 2620            |
| Fifty-foot sand.....  | 40                  | 2660            |
| Unrecorded .....  | 175                 | 2835            |
| Gordon Stray sand.....  | 23                  | 2858            |
| Unrecorded .....  | 7                   | 2865            |
| Gordon sand.....  | 23                  | 2888            |
| Unrecorded .....  | 12                  | 2900            |
| Fourth sand (oil, 2908').....   | 24                  | 2924            |
| Unrecorded to bottom.....   | 5                   | 2929            |
| 10" casing, 185'; 8¼" casing, 1250'; 6½" casing, 1678'; 5½" casing, 2167'; 4¼" casing, 742'. Bottom liner, 2865'. |                     |                 |
| Shot Sept. 10, 1907, with 15 quarts; shell; top, 2907'.   |                     |                 |
| Shot Jan. 2, 1902, with 20 quarts; 10' shell; top, 2907'.   |                     |                 |
| Shot Feb. 26, 1902 (?) with 20 quarts; 10' shell; top, 2907'.   |                     |                 |



**George Furbee No. 1 Well Record (497).**

Mannington district, 0.5 mile northwest of Mannington. Authority, Marsh Oil & Gas Company. Completed in 1911.

| (Elevation, 968' B-A. T.)                                       | Thickness. Total. |       |
|---|-------------------|-------|
|   | Feet.             | Feet. |
| Unrecorded .....  | 60                | 60    |
| Waynesburg coal .....   | 4                 | 64    |
| Unrecorded .....  | 377               | 441   |
| Pittsburgh coal.....  | 11                | 452   |
| Unrecorded .....  | 431               | 883   |
| Little Dunkard sand .....                                       | 30                | 913   |
| Unrecorded .....  | 93                | 1006  |
| Big Dunkard sand .....  | 94                | 1100  |
| Coal, anthracite? (Lower Freeport) .....                        | 3                 | 1103  |
| Unrecorded .....  | 23                | 1126  |
| Gas sand .....  | 128               | 1254  |
| Unrecorded .....  | 93                | 1347  |
| Salt sand (hole full of water, 1363') .....                     | 129               | 1476  |
| Unrecorded .....  | 219               | 1695  |
| Little Lime .....   | 15                | 1710  |
| Pencil cave .....   | 5                 | 1715  |
| Big Lime .....  | 40                | 1755  |
| Big Injun sand (gas, 1775'-1780'; oil show, 1865'-1871') .....  | 135               | 1890  |
| Unrecorded .....  | 130               | 2020  |
| Sand, (Squaw) (gas, 2024') .....                                | 4                 | 2024  |
| Unrecorded .....  | 346               | 2370  |
| Fifty-foot sand and unrecorded to bottom (Still drilling) ..... | ..                | ....  |

The above well starts 3 feet below the Waynesburg "A" coal according to Reger.

Along the northeastern edge of Mannington district there occurs a small oil pool of four wells on the head of Llewellyn run, the following record of one of which shows the producing horizon to be the Big Injun sand. A gas pay was encountered in the Big Lime:

**Daniel Varner No. 1 Well Record (487).**

Mannington district, 1.8 miles N., 80° E. of Condit. Authority, Burt Oil Company. Commenced July 15, 1898.

| (Elevation, 1155' B-A. T.)  | Thickness. Total. |       |
|---|-------------------|-------|
|   | Feet.             | Feet. |
| Conductor .....   | 16                | 16    |
| Unrecorded .....  | 594               | 610   |
| Mapletown (Sewickley) coal.....   | ..                | 610   |
| Unrecorded .....  | 100               | 710   |
| Pittsburgh coal .....   | ..                | 710   |
| Unrecorded .....  | 580               | 1290  |
| Dunkard sand and unrecorded to bottom .....   | 880               | 2170  |
| 10" casing, 185'; 8½" casing, 1290'; 6½" casing, 1590'; 5½" casing, 492' for liner 25 feet in Big Injun sand. Got oil at 2100 ft. cable measurement—steel line, 2123 ft. Big flow of gas 80 to 90 ft. above oil where the Big Lime should have been." |                   |       |

Southward on the same run and across on the head of Mahan run there are 8 or 10 gas wells in the Fifty-foot, Gantz and Fourth sands as shown by the five following records from wells in this region:

### Columbus Snodgrass No. 1 Well Record (489).

Mannington district, 1.4 miles east of Condit. Authority, Burt Oil Company.

| (Elevation, 1060' B-A.T.)       | Thickness. Total. |       |
|---------------------------------|-------------------|-------|
|                                 | Feet.             | Feet. |
| Unrecorded .....                | 210               | 210   |
| Bluff sand.....                 | 20                | 230   |
| Unrecorded .....                | 280               | 510   |
| Mapletown (Sewickley) coal..... | 5                 | 515   |
| Unrecorded .....                | 93                | 608   |
| Pittsburgh coal.....            | 9                 | 617   |
| Unrecorded .....                | 343               | 960   |
| Sand, (Moundsville).....        | 40                | 1000  |
| Unrecorded .....                | 76                | 1076  |
| Big Dunkard sand.....           | 117               | 1193  |
| Unrecorded .....                | 79                | 1272  |
| First gas sand.....             | 88                | 1360  |
| Unrecorded .....                | 10                | 1370  |
| Second gas sand.....            | 97                | 1467  |
| Unrecorded .....                | 66                | 1533  |
| Salt sand.....                  | 57                | 1590  |
| Unrecorded .....                | 30                | 1620  |
| Maxton sand.....                | 50                | 1670  |
| Unrecorded .....                | 191               | 1861  |
| Pencil cave.....                | 5                 | 1866  |
| Big Lime.....                   | 55                | 1921  |
| Big Injun sand.....             | 152               | 2073  |
| Unrecorded .....                | 474               | 2547  |
| Fifty-foot sand .....           | 58                | 2605  |
| Unrecorded .....                | 195               | 2800  |
| Gordon sand.....                | 37                | 2837  |
| Unrecorded .....                | 6                 | 2843  |
| Gordon sand.....                | 10                | 2853  |
| Unrecorded .....                | 4                 | 2857  |
| Fourth sand.....                | 49                | 2906  |
| Unrecorded to bottom.....       | 31                | 2937  |

### Thornton Fluharty No. 1 Well Record (490).

Mannington district, 1.1 mile southeast of Condit. Authority, Burt Oil Company.

| (Elevation, 1055' B-A.T.)       | Thickness. Total. |       |
|---------------------------------|-------------------|-------|
|                                 | Feet.             | Feet. |
| Unrecorded .....                | 150               | 150   |
| Bluff sand.....                 | 35                | 185   |
| Unrecorded .....                | 290               | 475   |
| Mapletown (Sewickley) coal..... | ...               | 475   |
| Unrecorded .....                | 100               | 575   |

|                                    | Thickness. | Total. |
|------------------------------------|------------|--------|
|                                    | Feet.      | Feet.  |
| Pittsburgh coal.....               | 5          | 580    |
| Unrecorded .....                   | 1251       | 1831   |
| Big Lime.....                      | 83         | 1914   |
| Big Injun sand.....                | 65         | 1979   |
| Unrecorded .....                   | 496        | 2475   |
| Fifty-foot sand (gas, 2480') ..... | 52         | 2527   |
| Unrecorded .....                   | 139        | 2766   |
| Gordon Stray sand.....             | 21         | 2787   |
| Unrecorded .....                   | 9          | 2796   |
| Gordon sand.....                   | 11         | 2807   |
| Unrecorded .....                   | 18         | 2825   |
| Fourth' sand.....                  | 44         | 2869   |
| Unrecorded to bottom.....          | 166        | 3035   |

### E. Wilson No. 1 Well Record (499).

Mannington district, 2.4 miles N 30° E of Mannington. Authority,  
South Penn Oil Company. Completed March 26, 1904.

|  | Thickness. | Total. |
|--|------------|--------|
|  | Feet.      | Feet.  |
| (Elevation, 1180' B-A.T.)  |            |        |
| Conductor .....  | 16         | 16     |
| Unrecorded .....   | 579        | 595    |
| Coal, Mapletown (Sewickley).....   | ..         | 595    |
| Unrecorded .....   | 101        | 696    |
| Pittsburgh coal (steel line measurement).....                              | 6          | 702    |
| Unrecorded .....   | 1273       | 1975   |
| Big Lime .....   | 65         | 2040   |
| Big Injun sand .....   | 129        | 2169   |
| Unrecorded .....   | 451        | 2620   |
| Sand, (Gantz) (gas, 2629') .....   | 18         | 2638   |
| Unrecorded .....   | 264        | 2902   |
| Gordon Stray sand .....  | 10         | 2912   |
| Unrecorded .....   | 12         | 2924   |
| Sand, (Fourth) (gas, 2930') .....  | 14         | 2938   |
| Unrecorded .....   | 20         | 2958   |
| Fourth sand (gas, 2961') and unrecorded to bottom .....                    | 15         | 2973   |
| 10" casing, 226'; 8½" casing, 1229'; 6½" casing, 1690'; 5½" casing, 2029'. |            |        |

### C. A. Kuhn No. 1 Well Record (500).

Mannington district, 2.3 miles N., 30° E. of Mannington. Author-  
ity, South Penn Oil Company. Completed Nov. 26, 1903.

|                            | Thickness. | Total. |
|----------------------------|------------|--------|
|                            | Feet.      | Feet.  |
| (Elevation, 1195' B-A. T.) |            |        |
| Conductor .....            | 16         | 16     |
| Unrecorded .....           | 680        | 696    |
| Pittsburgh coal .....      | ..         | 696    |
| Unrecorded .....           | 1264       | 1960   |
| Big Lime .....             | 57         | 2017   |
| Big Injun sand .....       | 154        | 2171   |
| Unrecorded .....           | 457        | 2628   |
| Fifty-foot sand .....      | 55         | 2683   |
| Unrecorded .....           | 235        | 2918   |

|  | Thickness. Total. |       |
|--|-------------------|-------|
|  | Feet.             | Feet. |
| Gordon sand .....                                      | 22                | 2940  |
| Unrecorded .....                                       | 12                | 2952  |
| Fourth sand (gas, 2954') .....                         | 62                | 3014  |
| Unrecorded .....                                       | 100               | 3114  |
| Sand, (Bayard) .....                                   | 2                 | 3116  |
| Unrecorded to bottom .....                             | 16                | 3132  |
| 10" casing, 219'; 8" casing, 1218'; 6½" casing, 1997'. |                   |       |

### Ozias Kuhn No. 1 Well Record (501).

Mannington district, 2 miles N 30° E of Mannington. Authority, South Penn Oil Company. Completed March 5, 1895.

|   | Thickness. Total. |       |
|---|-------------------|-------|
|   | Feet.             | Feet. |
| Unrecorded .....  | 585               | 585   |
| Coal, Mapletown (Sewickley) .....   | ...               | 585   |
| Unrecorded .....  | 83                | 668   |
| Pittsburgh coal .....   | 7                 | 675   |
| Unrecorded .....  | 1230              | 1905  |
| Big Lime .....  | 75                | 1980  |
| Big Injun sand (gas, 1987') .....   | 110               | 2090  |
| Unrecorded .....  | 470               | 2560  |
| Gantz sand and unrecorded .....   | 70                | 2630  |
| Fifty-foot sand (gas, 2640') and unrecorded .....   | 236               | 2896  |
| Sand, (Fourth) (gas, 2910'-2915') to bottom .....   | 28                | 2924  |
| 13½" casing, 41'; 10" casing, 197'; 8¼" casing, 1216'; 6¾" casing, 1727'; 5⅝" casing, 2668'; 4½" x 4" casing, 300' (bottom at 2896'). |                   |       |
| Shot Jan. 28, 1901, with 15 quarts; 10' shell, top 2030'.   |                   |       |

The following record of an isolated oil well on the head of Mahan run shows that the producing horizon is the Big Injun sand:

### James Fluharty No. 1 Well Record (498).

Mannington district, 2.4 miles N 25° E of Mannington. Authority, South Penn Oil Company. Completed January 5, 1903.

|  | Thickness. Total. |       |
|--|-------------------|-------|
|  | Feet.             | Feet. |
| (Elevation, 1305' B-A.T.)  |                   |       |
| Conductor .....  | 16                | 16    |
| Unrecorded .....   | 698               | 714   |
| Mapletown (Sewickley) coal .....                                     | ...               | 714   |
| Unrecorded .....   | 104               | 818   |
| Pittsburgh coal .....  | ...               | 818   |
| Unrecorded .....   | 752               | 1670  |
| Salt sand (water, 1755') .....                                       | 203               | 1873  |
| Unrecorded .....   | 207               | 2080  |
| Pencil cave .....  | 5                 | 2085  |
| Big Lime .....   | 70                | 2155  |
| Big Injun sand (first oil pay, 2239') and unrecorded to bottom ..... | 99                | 2254  |
| 10" casing, 230'; 8¼" casing, 1322'11"; 6¾" casing, 2104'10".        |                   |       |

**The Mannington Oil Pool.**—The great Mannington oil pool belongs on a structural terrace on the western slope of the Wolf Summit anticline as shown by the wide divergence of the 500 and the 650-foot contours of the Pittsburgh coal bed southwestward from the Pawpaw-Lincoln district line. The Flat Run and the Mt. Morris-Fairview oil belts are separated by a width of 2 to 3 miles at the Monongalia-Marion county line, but southwestward they converge into one unbroken belt of wells from one mile north of Mannington to a point  $4\frac{1}{2}$  miles southwest of the latter place. The pool has a width of 4 miles westward from Downs, but tapers down to a width of one-half mile at its southwestern terminus, 1.3 miles north of Pleasantville. The main producing sands therein are the Big Injun, Gordon and Fourth. Within the boundaries of Mannington district 275 to 300 wells have been drilled in this oil belt southwest from the Lincoln-Mannington district line, 90 to 95 per cent of which were oil producers. The sudden termination of the pool to the southwest on the waters of Coal Lick run may be indirectly due to several causes combined, but the gradual disappearance in this direction of the structural terrace referred to above as revealed on Map II by the convergence of the 500 and the 650-foot contours of the Pittsburgh coal bed in the region of Pleasantville, resulting in the steepening of the structural slope in the Pleasantville region, has no doubt been an important contributing element. The initial oil production of the wells ranged from 5 to over 3600 barrels daily.

As mentioned on a preceding page, the **Fleming Hamilton No. 1 well (541)**, located on the waters of Flaggy Meadow, 0.5 mile south of Mannington and completed Oct. 11, 1889, was the first well drilled in the Mannington field, a copious showing of oil therein being encountered in the Big Injun sand. The 11 following records from wells in this field, scattered from Mannington southwestward to near Pleasantville (Joetown), give interesting data as to the oil and gas horizons and the minable coals:

**B. F. Blackshere No. 15 Well Record (502).**

Mannington district, 0.6 mile northwest of Downs. Authority, South Penn Oil Company.

|   | Thickness. Total. |       |
|---|-------------------|-------|
|   | Feet.             | Feet. |
| (Elevation, 1250' B-A. T.)                              |                   |       |
| Conductor .....   | 14                | 14    |
| Unrecorded .....  | 516               | 530   |
| Mapletown (Sewickley) coal .....                        | ..                | 530   |
| Unrecorded .....  | 102               | 632   |
| Pittsburgh coal .....                                   | 7                 | 639   |
| Unrecorded .....  | 911               | 1550  |
| Salt sand (water, 1570') .....                          | 90                | 1640  |
| Unrecorded .....  | 267               | 1907  |
| Pencil cave .....                                       | 5                 | 1912  |
| Big Lime .....  | 78                | 1990  |
| Big Injun sand (gas, 1998'; oil, 2100') to bottom ..... | 135               | 2125  |
| 10" casing, 327'.                                       |                   |       |

**F. H. Burt No. 15 Well Record (505).**

Mannington district, at Mannington. Authority, Burt Oil Company. Completed January, 1892.

|   | Thickness. Total. |       |
|---|-------------------|-------|
|   | Feet.             | Feet. |
| (Elevation, 1000' B-A. T.)  |                   |       |
| Unrecorded .....  | 445               | 445   |
| Pittsburgh coal .....   | ..                | 445   |
| Unrecorded .....  | 1343              | 1788  |
| Big Injun sand (first oil pay, 1858'; second, 1865'-1867') and unrecorded ..... | 93                | 1881  |
| Black slate to bottom .....   | 15                | 1896  |
| 10" casing, 1151'; 7% casing, 473'; 6¼" casing, 980'; 4% casing, 1717'6".       |                   |       |
| Shot in 1892 with 8 quarts.   |                   |       |
| Shot in 1895 with 10 quarts in each pay.  |                   |       |

**F. H. Burt No. 14 Well Record (508).**

Mannington district at Mannington. Authority, Burt Oil Company.

|  | Thickness. Total. |       |
|--|-------------------|-------|
|  | Feet.             | Feet. |
| (Elevation, 1057' L-A. T.)                                 |                   |       |
| Unrecorded .....   | 510               | 510   |
| Pittsburgh coal .....                                      | ..                | 510   |
| Unrecorded .....   | 1328              | 1838  |
| Big Injun sand (first oil pay, 1914'; second, 1924') ..... | 101½              | 1939½ |
| Unrecorded .....   | 783½              | 2723  |
| Fourth sand (oil pay, 2723') .....                         | 19                | 2742  |
| Slate, dark, soft .....                                    | 20                | 2762  |
| Fourth sand .....  | 16                | 2778  |
| Dark slate to bottom .....                                 | 212               | 3000  |
| 10" casing, 255'; 7% casing, 1030'; 5% casing, 1782'.      |                   |       |

**G. M. Floyd No. 1 Well Record (512).**

Mannington district, 1.5 miles S 75° W of Mannington. Authority, South Penn Oil Company. Completed July 17, 1894.

| (Elevation, 1000' B-A.T.)   | Thickness. Total. |       |
|---|-------------------|-------|
|   | Feet.             | Feet. |
| Conductor .....   | 18                | 18    |
| Unrecorded .....  | 479               | 497   |
| Pittsburgh coal.....  | ...               | 497   |
| Unrecorded .....  | 530               | 1027  |
| Dunkard sand.....   | 40                | 1067  |
| Unrecorded .....  | 283               | 1350  |
| Salt sand (water, 1380').....   | 125               | 1475  |
| Unrecorded .....  | 370               | 1845  |
| Big Injun sand.....   | 140               | 1985  |
| Unrecorded .....  | 455               | 2440  |
| Fifty-foot sand (gas, 2450').....   | 50                | 2490  |
| Unrecorded .....  | 185               | 2675  |
| Gordon Stray sand and unrecorded.....   | 30                | 2705  |
| Fourth sand (first oil pay, 2709'; second pay, 2715') to bottom .....                                 | 35                | 2740  |
| 10" casing, 230'; 8¼" casing, 1035'9"; 6¾" casing, 1519'; 5½" casing, 1975'10"; 4½ x 4" casing, 771'. |                   |       |
| Shot Dec. 27, 1894, with 12 quarts; 8' shell, top, 2709'.   |                   |       |
| Shot June 7, 1895, with 24 quarts; 12' shell, top, 2709'.   |                   |       |
| Shot June 21, 1899, with 24 quarts; 25' anchor.   |                   |       |
| Shot July 10, 1899, with 50 quarts; short shells, top, 2708'.   |                   |       |

The above well starts 32 feet by hand-level below the Washington coal, according to Mr. Reger.

The R. P. Floyd No. 1 well (513), located 2 miles southwest of Mannington, drilled by the U. S. Oil Company and now owned by the South Penn Oil Company, was the largest producer in this pool.

**J. W. Conaway No. 3 Well Record (515).**

Mannington district, 2.2 miles southwest of Mannington. Authority, South Penn Oil Company. Completed January 9, 1894.

| (Elevation, 1064' B-A.T.)        | Thickness. Total. |       |
|----------------------------------|-------------------|-------|
|                                  | Feet.             | Feet. |
| Conductor .....                  | 16                | 16    |
| Unrecorded .....                 | 124               | 140   |
| Bluff sand.....                  | 70                | 210   |
| Unrecorded .....                 | 262               | 472   |
| Coal, Mapletown (Redstone) ..... | 4                 | 476   |
| Unrecorded .....                 | 32                | 508   |
| Pittsburgh coal .....            | 6                 | 514   |
| Unrecorded .....                 | 541               | 1055  |
| Dunkard sand .....               | 65                | 1120  |
| Unrecorded .....                 | 715               | 1835  |
| Big Injun sand .....             | 30                | 1965  |

|  |     |      |
|--|-----|------|
| Unrecorded .....   | 465 | 2430 |
| Gantz and Fifty-foot sands (gas, 2460') .....  | 105 | 2535 |
| Unrecorded .....   | 175 | 2710 |
| <b>Fourth sand (first pay, 2710'; increased to total depth)</b>  |     |      |
| to bottom .....  | 5   | 2715 |
| 10" casing, 213'; 8¼" casing, 1063'.. 6½" casing, 1450'; 5⅜" casing, 2107'5"; 4¼"x4" liner, 631'; bottom at 2710'. |     |      |
| "Shot March 19, 1902, with 24 quarts; 12' shell, top, 2709'.   |     |      |
| "Shot July 8, 1902, with 30 quarts; 5' shell, top, 2709'.  |     |      |

The above well starts 16 feet by hand-level below the Washington coal, according to Reger.

The **Michael Kennedy No. 1 well (516)**, located on the head of Whetstone run, the log of which is published in connection with the Whetstone Run Section, page 127, had an initial oil production of over 1000 bbls. daily from the Fourth sand.

**Martha B. Shafer No. 2 Well Record (525).**

Mannington district, 2.3 miles northeast of Pleasantville. Authority, Chartiers Oil Company.

| (Elevation, 1275' B-A. T.)  | Thickness. Total. |       |
|---|-------------------|-------|
|   | Feet.             | Feet. |
| Unrecorded .....  | 737               | 737   |
| Pittsburgh coal .....   | ..                | 737   |
| Unrecorded .....  | 1298              | 2935  |
| <b>Fourth sand (oil, 2943'-2955') to bottom</b> .....                     | 20                | 2955  |
| Not through sand.   |                   |       |
| 10" casing, 420'; 8¼" casing, 1288'; 6½" casing, 2208'; 5⅜" casing, 676'. |                   |       |

**William Wright No. 1 Well Record (527).**

Mannington district, 2 miles N., 20° E. of Pleasantville. Authority, South Penn Oil Company.

| (Elevation, 1270' B-A. T.)            | Thickness. Total. |       |
|---------------------------------------|-------------------|-------|
|                                       | Feet.             | Feet. |
| Unrecorded .....                      | 740               | 740   |
| Pittsburgh coal.....                  | 8                 | 748   |
| Unrecorded .....                      | 982               | 1730  |
| Salt sand.....                        | 55                | 1785  |
| Unrecorded (no Dunkard sand).....     | 205               | 1990  |
| Big Lime.....                         | 64                | 2054  |
| Big Injun sand (no oil or water)..... | 121               | 2175  |
| Unrecorded .....                      | 550               | 2725  |
| Fifty-foot sand (gas, 2730').....     | 50                | 2775  |
| Unrecorded .....                      | 115               | 2890  |
| Stray sand.....                       | 18                | 2908  |
| Slate .....                           | 2                 | 2910  |
| Fourth sand (oil) to bottom.....      | 28                | 2938  |

The above well, having an initial oil production of 3600 bbls. daily from the Fourth sand, was among the largest struck in the field.



### P. Gaughan No. 1 Well Record (530).

Mannington district, 1.5 miles north of Pleasantville, about one mile west from Morgan gas well and about four miles south from Mannington, Marlon county. Authority, South Penn Oil Company.

|  | Thickness. Total. |       |
|--|-------------------|-------|
|  | Feet.             | Feet. |
| Unrecorded .....   | 584               | 584   |
| <b>Pittsburgh coal</b> .....   | 8                 | 592   |
| Unrecorded .....   | 1228              | 1820  |
| Big Lime.....  | 80                | 1900  |
| <b>Big Injun sand</b> (gas, 1950'; oil and water, 1998'; oil, 2009') ..... | 150               | 2050  |
| Unrecorded (gas, 2494').....   | 444               | 2494  |
| Gantz sand .....   | 15                | 2509  |
| Slate .....  | 15                | 2524  |
| Gantz sand.....  | 24                | 2548  |
| Slate .....  | 16                | 2564  |
| Fifty-foot sand.....   | 31                | 2595  |
| Red rock .....   | 30                | 2625  |
| <b>Thirty-foot sand</b> (gas, 2654').....                                  | 29                | 2654  |
| Shells and slate (no good sand).....                                       | 203               | 2857  |

### E. C. Morgan No. 1 Well Record (534).

Mannington district, 1.5 miles northeast of Pleasantville. Authority, South Penn Oil Company. Completed in 1893.

| (Elevation, 1455' B-A.T.)  | Thickness. Total. |       |
|--|-------------------|-------|
|  | Feet.             | Feet. |
| Conductor .....  | 14                | 14    |
| Unrecorded .....   | 868               | 882   |
| <b>Pittsburgh coal</b> .....   | 8                 | 890   |
| Unrecorded (no Dunkard sand; salt water, 1680').....                       | 1264              | 2154  |
| Big Lime.....  | 60                | 2214  |
| <b>Big Injun sand</b> (salt water and oil, 2340') .....                    | 131               | 2345  |
| Unrecorded .....   | 425               | 2770  |
| Gantz sand.....  | 60                | 2830  |
| Slate .....  | 70                | 2900  |
| Red rock.....  | 20                | 2920  |
| Thirty-foot sand.....  | 50                | 2970  |
| Slate .....  | 20                | 2990  |
| Stray sand.....  | 55                | 3045  |
| Slate .....  | 7                 | 3052  |
| <b>Gordon sand</b> (strong gas, 3055').....                                |                   |       |
| 10" casing, 505'; 8¼" casing, 1276'; 6½" casing, 2192'; 5½" casing, 2635'. |                   |       |

The above well is reported to have been the **greatest gasser** ever encountered in the State, and is the famous Morgan well mentioned by I. C. White on pages 69-70 of Vol. I(A) of the State Survey Reports, where the following is given:

" \* \* \* \* \* so great was its pressure, that the drilling tools weighing several thousand pounds, were lifted from the bottom of the

well, and blown above the top of the derrick more than 100 feet into the air through 6½" casing, according to Mr. Worthington. The well defied all the usual methods of procedure in shutting in large gas wells, and only after three months of uninterrupted work was it finally conquered by the ingenuity of Messrs. Edwards and Worthington, and the men whom they directed. The 3-inch tubing could not be inserted in the 6½" in the customary manner, but required the pull of 'block and tackle' to force it into the well. Then when the proper depth (2270 feet) had been reached, where it was decided to set the rubber packer, it would not 'take hold,' and on withdrawing the tubing no rubber was visible, the fine sand and pebbles having been blown by the gas against it with such force as to destroy the rubber entirely and blow its material out as dust. This occurred several times until Messrs. Edwards and Worthington decided to wrap the 'packer' with iron wire before inserting the same, which finally proved successful and the well was shut in. This is the well which gave a pressure of 800 pounds (the limit of the gauge) almost instantly, or within two or three seconds, according to Mr. Edwards. The well was completed on the 19th of August, 1893, and after supplying the towns of Fairmont and Grafton, 25 miles distant, for four years, still showed a rock pressure at the well of 765 pounds, January 1, 1898, and of 550 pounds January 1, 1899. Its production through the open casing when first struck, must have been enormous, probably between 35 and 40 million cubic feet daily."

### Lindsay Blaker No. 1 Well Record (536).

Mannington district, 0.7 mile northeast of Pleasantville. Authority, South Penn Oil Company.

| (Elevation, 1115' B-A.T.)           | Thickness. Total. |       |
|-------------------------------------|-------------------|-------|
|                                     | Feet.             | Feet. |
| Conductor .....                     | 15                | 15    |
| Slate and shells .....              | 70                | 85    |
| Coal, (Waynesburg "A") .....        | 2                 | 87    |
| Slate, limestone and sand .....     | 68                | 155   |
| Trace of coal, (Waynesburg) .....   | 3                 | 158   |
| Gray sand (water) .....             | 10                | 168   |
| Slate .....                         | 10                | 178   |
| Sand .....                          | 25                | 203   |
| Shale, blue .....                   | 45                | 248   |
| Slate, black .....                  | 17                | 265   |
| Slate .....                         | 25                | 290   |
| Limestone .....                     | 25                | 315   |
| Slate .....                         | 25                | 340   |
| Limestone .....                     | 78                | 418   |
| Slate .....                         | 10                | 428   |
| Coal, (Mapletown) (Sewickley) ..... | 2                 | 430   |
| Limy shells .....                   | 10                | 440   |
| Slate .....                         | 40                | 480   |
| Limestone and slate .....           | 20                | 500   |
| Slate .....                         | 30                | 530   |
| Pittsburgh coal .....               | 8                 | 538   |
| Limestone .....                     | 25                | 563   |
| Slate and shells .....              | 60                | 623   |
| Slate, pink .....                   | 15                | 638   |
| Slate, blue .....                   | 30                | 668   |
| Limy shells and slate .....         | 40                | 708   |

|  | Thickness.     | Total    |
|--|----------------|----------|
|  | Feet.          | Feet.    |
| Red rock.....  | 50             | 758      |
| Slate, blue.....   | 30             | 788      |
| Limy shells and slate.....   | 25             | 813      |
| Slate, dark colored.....   | 20             | 833      |
| Limy shells and slate.....   | 15             | 848      |
| Dark colored clay.....   | 15             | 863      |
| Slate, pink.....   | 10             | 873      |
| Sandy shells and slate.....  | 40             | 913      |
| Slate, pink.....   | 40             | 953      |
| Slate, blue.....   | 35             | 988      |
| Sand and shells.....   | 35             | 1023     |
| Slate.....   | 15             | 1038     |
| Limestone, blue.....   | 30             | 1068     |
| Slate, blue.....   | 10             | 1078     |
| Limestone.....   | 14             | 1092     |
| Dunkard sand.....  | 10             | 1102     |
| Limestone.....   | 20             | 1122     |
| Slate.....   | 10             | 1132     |
| Limestone.....   | 30             | 1162     |
| Sand.....  | 20             | 1182     |
| Slate, black.....  | 5              | 1187     |
| Limestone, blue.....   | 20             | 1207     |
| Limestone, brown.....  | 25             | 1232     |
| Sand, white (Lower Freeport) (Gas sand).....                                 | 83             | 1315     |
| Trace of coal (Lower Kittanning).....  | 2              | 1317     |
| Slate.....   | 40             | 1357     |
| Sand.....  | 25             | 1382     |
| Slate (Salt sand, 1387').....  | 10             | 1392     |
| Limestone, brown.....  | 10             | 1402     |
| Salt sand (salt water).....  | 158            | 1560     |
| Limestone, brown.....  | 10             | 1570     |
| Slate, brown.....  | 20             | 1590     |
| Limestone, brown.....  | 80             | 1670     |
| Red rock.....  | 65             | 1735     |
| Limy shells and slate.....   | 30             | 1765     |
| Red rock.....  | 10             | 1775     |
| Limestone, gray.....   | 7              | 1782     |
| Slate.....   | 3              | 1785     |
| Limestone (Big Lime).....  | 72             | 1857     |
| Sand, hard on top (Big Injun)<br>(gas, 1870').....                           | 13'            |          |
| Sand.....  | 3              |          |
| Break of slate.....  | 4              |          |
| Sand.....  | 19             |          |
| Limestone, gritty.....   | 42             |          |
| Sand, gray.....  | 9              |          |
| Break of slate.....  | 3              |          |
| Sand (first oil, 1965').....   | 15             |          |
| 10" casing, 265'; 8¼" casing, 863'; 6¼" casing, 1092'; 4¾" casing,<br>1842'. |                |          |
|  | Big Injun..... | 108 1965 |

**M. S. Snodderly No. 1 Well Record (543).**

Mannington district, 2 miles S 30° W of Mannington. Authority, South Penn Oil Company.

|   | Thickness. Total |       |
|---|------------------|-------|
|   | Feet.            | Feet. |
| (Elevation, 1205' B-A.T.)   |                  |       |
| Conductor .....   | 36               | 36    |
| Unrecorded .....  | 601              | 637   |
| <b>Pittsburgh coal</b> .....  |                  | 637   |
| Unrecorded .....  | 913              | 1540  |
| Salt sand (gas, 1570') and unrecorded.....  | 432              | 1972  |
| <b>Big Injun sand</b> (gas, 2007'; first oil pay, 2069'; second oil, 2079') and unrecorded to bottom..... | 135              | 2107  |
| 10" casing, 144'; 7½" casing, 682'; 6¼" casing (setter), 610'; 4¾" casing, 1570.                          |                  |       |

Pressure test in Salt sand at end of

|                      |                      |
|----------------------|----------------------|
| 1st minute, 160 lbs. | 4th minute, 380 lbs. |
| 2nd minute, 280 lbs. | 5th minute, 390 lbs. |
| 3rd minute, 850 lbs. | 6th minute, 400 lbs. |

Packed December 20, 1890, with 4' anchor.

Shot in 1902 with 8 quarts; 10' shell, top, 2069'.

Shot in 1902 with 10 quarts; 6' shell, top, 2078'.

In addition to the brief logs as given in the table of wells for Marion county the much more complete records of the three wells listed below are given on the pages indicated of Vol. I(A) of the State Survey reports:

| No. on Map. | Name of Well          | Location.                               | Page of Vol. I(A). |
|-------------|-----------------------|---|--------------------|
| 520         | Z. Kendall No. 3..... | Whetstone run, head of.                 | 163                |
| 529         | P. G. Hall No. 3..... | Pleasantville, 1.7 miles N 5° E of..... | 164                |
| 535         | Abram Ashcraft.....   | Pleasantville, 1 mile NE of .....       | 175                |

No. 520 was Big Injun sand oil producer.

No. 529 had oil in both the Big Injun and Fourth, with gas in Fifty-foot.

No. 535 was a gasser in Gordon sand.

In the extreme edge of Mannington district the Clark Oil Company drilled a couple of small Thirty-foot oil producers. 1.5 miles westward from Pleasantville. The log of one of these wells—**Isabel Moore No. 1 (477)**—is published on page 488 of the Doddridge-Harrison report of the State Survey:

The detailed log of the J. C. Straight No. 2 well (519), located 3 miles southwest of Mannington, is published on pages 243 and 244 of Vol. 1 of the State Survey reports. It was an oil producer in the Fourth, with oil show in Big Injun and gas shows in the Fifth and Bayard sands.

The southeastern corner of Mannington district has been elevated to a relatively high structural level by the Wolf Summit anticline; hence, in that territory southeast of the Mannington oil pool there are 30-35 gas wells in which the Gordon, Fourth and Fifth sands appear to be the main producing horizons.

**Prospective Oil and Gas Areas, Mannington District.**—Mannington district has been more thoroughly prospected for oil and gas than any other in Marion county, yet there remain several scattered areas that are favored both by structure and development to warrant the drilling of test wells thereon. Taking up these areas roughly from northwest to southeast across the district, (1) that territory lying on the heads of Big and Campbell runs along the Marion-Wetzel county line appears favorable for oil in the Thirty-foot and Gordon sands; (2) that, 2 miles westward from Glover Gap on the waters of Beechlick, immediately along the axis of the Robinson syncline as outlined on Map II, for Big Injun gas, and Thirty-foot, Gordon and Fourth sand oil; (3) that, northward from Brink on the waters of Starkey run for Big Injun oil and for gas at the same horizon and in the deeper sands down to and including the Fourth; (4) that, immediately along the axis of the Robinson syncline southward from Evans' run to Owen Davy fork, for Maxton and Gordon oil; (5) that, northeastward from the main valley of Campbell run to the Marion-Monongalia county line between the 225 and the 250-foot contours of the Pittsburgh coal bed as outlined on Map II, for oil in the Gordon and Fourth sands; (6) that, included in the drainage of Dents and Rex runs between the 300 and the 350-foot contours of Pittsburgh coal, for Big Injun gas and Thirty-foot oil; (7) that, on the waters of Hibb's run northward from the 375-foot contour of Pittsburgh coal, would justify a further test for Fourth sand oil; (8) that, along both hillsides of Bartholomew fork southward from well No. 453 to the mouth of the stream, for Thirty-foot sand oil; (9) that, southwestward from Logansport to the head of Huey run along the east side of and adjacent to the 350-foot contour of Pittsburgh coal, Thirty-foot oil; (10) that,

northeastward from Margaret to the divide between Glade and Bingamon and westward from the 450 to the 375-foot contour of Pittsburgh coal, for oil at the same horizon; and (11) that, in the southeast corner of the district on the waters of Big run would justify several more wells for gas in the Big Injun and deeper sands.

### *Pawpaw District.*

Pawpaw district adjoins Monongalia and occupies the northeast portion of Marion county. Its area is traversed by two structural folds as shown on Map II; viz., the Mooresville anticline and the Lambert syncline, the latter being very shallow on its western rim. The Mt. Morris-Fairview oil belt crosses the western portion of the district, in which the Big Injun and Bayard sands are main oil horizons. Eastward on the broad crest of the Mooresville arch there occurs a very important gas field of Marion county.

Taking up the development in Pawpaw from west to east, one-half dozen oil wells of the Flat Run oil pool are included within the extreme western point of the district. The log of the **Noah Price No. 1 well (351)**, located 0.4 mile southeast of Galletin, is published on pages 231-232 of Vol. I of the State Survey reports. It had an initial oil production of 300 barrels daily from the Fourth sand, along with a showing of oil and gas in the Big Injun and a show of gas in the Gantz sand.

Two miles eastward on the north hillside of State Road run, the **Joseph Michael No. 1 well (552)** is reported to have had a 4 to 5-barrel oil show in the Big Injun sand, according to Jasper Clayton, residing near the boring, who says that it was completed only to the Big Injun sand about 16 years ago.

About 100 producing oil wells have been drilled within the boundaries of Pawpaw district in the Mt. Morris-Fairview oil belt. The data given on pages 141-142 and 156-157 of Vol. I(A) of the State Survey reports show that the Big Injun and Bayard (not the Fifth) sands are the principal oil horizons. The log of the **P. B. Amos No. 1 well (553)**, located in this field 1.2 miles northward from Fairview, is published on page

156 of the last mentioned report. Therein this well's initial production is given as 75 barrels daily from the Bayard sand.

The lasting qualities of the Bayard wells in this field are well illustrated by the M. E. Brookover No. 4 well, mentioned on page 157 of the same report, its initial production being 200 barrels daily in July, 1903, and still yielding 68 barrels daily on June 5, 1904. The four following records from wells scattered throughout this oil belt in Pawpaw give much data of interest.

### David Jones No. 1 Well Record (554).

Pawpaw district, 0.9 mile north of Fairview. Authority, South Penn Oil Company. Completed January 6, 1891.

|  | Thickness.<br>Feet. | Total<br>Feet. |
|--|---------------------|----------------|
| (Elevation, 1018' L)   |                     |                |
| Unrecorded .....   | 473                 | 473            |
| Pittsburgh coal.....   | ..                  | 473            |
| Unrecorded .....   | 1346                | 1819           |
| Big Injun sand (first pay, 1885'; second, 1900') and unrecorded to bottom..... | 110                 | 1929           |
| 10" casing, 108'; 8¼" casing, 505'; 6½" casing, 1047'; 5" casing, 1736'        |                     |                |

Shot January 11, 1900, with 12 quarts; May 26, 1900, with 20 quarts; May 10, 1910, 20 quarts; 4¼" x 6" shell; top, 1899'.

The above well had an initial oil production of 40 bbls. daily from the Big Injun.

### David Jones No. 5 Well Record (556).

Pawpaw district, 0.9 mile N 10° W of Fairview. Authority, South Penn Oil Company. Completed January 31, 1906.

|   | Thickness.<br>Feet. | Total<br>Feet. |
|---|---------------------|----------------|
| Conductor .....                                       | 14                  | 14             |
| Unrecorded .....                                      | 306                 | 320            |
| Coal, native, (Waynesburg).....                       | 4                   | 324            |
| Unrecorded .....                                      | 271                 | 595            |
| Coal, Mapletown (Sewickley) .....                     | 7                   | 602            |
| Unrecorded .....                                      | 93                  | 695            |
| Pittsburgh coal.....                                  | 9                   | 704            |
| Unrecorded .....                                      | 521                 | 1225           |
| Dunkard sand and unrecorded.....                      | 95                  | 1320           |
| Gas sand and unrecorded.....                          | 320                 | 1640           |
| Salt sand (water, 1700').....                         | 290                 | 1930           |
| Big Lime.....   | 60                  | 1990           |
| Big Injun sand (first pay, 2110'; second, 2133')..... | 190                 | 2180           |
| Unrecorded .....                                      | 430                 | 2610           |
| Gantz and Fifty-foot.....                             | 100                 | 2710           |
| Unrecorded .....                                      | 407                 | 3117           |
| Bayard sand (pay 3118', 10 bbls.).....                | 20                  | 3137           |
| Unrecorded to bottom.....                             | 6                   | 3143           |

Shot July 5, 1906, with 20 quarts; Oct. 7, 1907, with 30 quarts; Sept. 7, 1911, with 20 quarts in 4¼" x 6'9" shell, top, 2109'; Sept. 19, 1911, with 20 quarts in 4¼" x 6'9" shell, top, 2131'.

### G. W. Toothman No. 5 Well Record (557).

Pawpaw district, 0.6 mile north of Fairview. Authority, South Penn Oil Company. Completed May 21, 1893.

|   | Thickness.<br>Feet. | Total<br>Feet. |
|---|---------------------|----------------|
| Conductor .....   | 32                  | 32             |
| Unrecorded .....  | 543                 | 575            |
| Pittsburgh coal.....  |                     | 575            |
| Unrecorded .....  | 1340                | 1915           |
| Big Injun sand (first pay, 1982'; second, 1993') and un-<br>recorded to bottom..... | 107                 | 2022           |
| 10" casing, 600'; 8¼" casing, 792'; 6½" casing, 1667'; 5⅜"<br>casing, 674'.         |                     |                |

Shot March 1, 1895, with 3 quarts; July 3, 1895, with 4 quarts; Dec. 13, 1896, with 6 quarts; June 9, 1896, with 6 quarts; July 5, 1897, with 12 quarts; May 11, 1898, with 16 quarts; May 23, 1899, with 30 quarts; Sept., 1902, with 40 quarts; Nov. 22, 1909, with 40 quarts in two 4¼" x 6'9" shells; top of first, 1992'; top of second, 1991'.

The initial production of the above, 1000 bbls. of oil daily from Big Injun, and it was still making 8 bbls. daily in August, 1911.

### G. W. Toothman No. 1 Well Record (558).

Pawpaw district, 0.5 mile north of Fairview. Authority, South Penn Oil Company.

|   | Thickness.<br>Feet. | Total<br>Feet. |
|---|---------------------|----------------|
| (Elevation, 1035' B.A.T.)   |                     |                |
| Unrecorded .....  | 1780                | 1780           |
| Big Injun sand (gas, 1795'; first pay, 1850'; second, 1875')<br>and unrecorded to bottom.....   | 137                 | 1917           |
| Shot Feb. 28, 1893, with 30 quarts; Aug. 10, 1898, with 40 quarts;<br>No. 6, 1908, with 20 quarts; 4¼" x 6'9" shell, top, 1849'; Nov. 9, 1908,<br>with 20 quarts; 4¼" x 6'9" shell, top, 1850'. |                     |                |

Initial oil production, 8 bbls. daily, but only ½ bbl. daily in 1911. 21 years after completion.

The detailed log of the P. W. Yost No. 1 well (560), located 0.5 mile west of Fairview, is published on pages 239-240 of Vol. I of the State Survey reports. This well had an initial oil production of 100 barrels daily from the Big Injun sand, and a fair oil show in the Gas sand, an account of which is given under the description of the latter formation, page 391.

Along the crest and a short distance down each slope of the Mooresville anticline there occurs a fine gas field in which



about 40 gassers have already been drilled. The five following records from wells therein show that the Big Injun, Thirty-foot, Fifth and Bayard sands are the main producing horizons:

### Alice (Kuhn) Lamberton No. 1 Well Record (564).

Pawpaw district, 1.6 miles northeast of Fairview. Authority, Carnegie Natural Gas Company. Completed July 27, 1907.

| (Elevation, 1140' B-A.T.)  | Thickness. Total |      |
|--|------------------|------|
|  | Feet.            | Feet |
| Unrecorded .....   | 465              | 465  |
| Pittsburgh coal.....   | 7                | 472  |
| Unrecorded .....   | 1280             | 1752 |
| Big Injun sand.....  | 178              | 1930 |
| Unrecorded .....   | 920              | 2850 |
| Bayard sand (little gas, 2858'-2867').....                               | 20               | 2870 |
| 10" casing, 484'; 8¼" casing, 1380'; 6½" casing, 1500'; 3" tubing, 2874. |                  |      |

Pressure test, first minute in 3" tubing, 100 lbs.

### James Eddy No. 1 Well Record (569).

Pawpaw district, 2.2 miles northeast of Basnett. Authority, Carnegie Natural Gas Company. Completed Feb. 1, 1907.

| (Elevation, 1065' B-A.T.)   | Thickness. Total |       |
|---|------------------|-------|
|   | Feet.            | Feet. |
| Unrecorded .....  | 400              | 400   |
| Pittsburgh coal.....  | ...              | 400   |
| Unrecorded .....  | 1280             | 1680  |
| Big Injun sand (gas 1700-1810).....   | 170              | 1850  |
| Unrecorded .....  | 350              | 2200  |
| Berea sand (gas, 2210').....  | 45               | 2245  |
| Unrecorded .....  | 502              | 2747  |
| Fifth sand (gas, 2752') .....   | 23               | 2770  |
| Unrecorded .....  | 4                | 2774  |
| Bayard sand (little gas, 2785').....  | 31               | 2805  |
| Unrecorded to bottom.....   | 16               | 2821  |
| 10" casing, 456'; 8¼" casing, 1070'; 6½" casing, 1410'; 5½" casing, 1870'). |                  |       |

### W. R. Toothman No. 1 Well Record (572).

Pawpaw district, 1.2 miles east of Basnett. Authority, Carnegie Natural Gas Company. Completed Aug. 24, 1911.

| (Elevation, 1215' B-A.T.)                 | Thickness. Total |       |
|---|------------------|-------|
|   | Feet.            | Feet. |
| Unrecorded .....                          | 490              | 490   |
| Coal, Pittsburgh .....                    | ...              | 490   |
| Unrecorded .....                          | 1350             | 1840  |
| Big Injun sand (some gas at 1928').....   | 113              | 1953  |
| Unrecorded .....                          | 532              | 2485  |
| Thirty-foot sand (little gas, 2495')..... | 35               | 2520  |

|                               | Thickness.<br>Feet. | Total.<br>Feet. |
|-------------------------------|---------------------|-----------------|
| Unrecorded .....              | 190                 | 2710            |
| Gordon sand .....             | 25                  | 2735            |
| Unrecorded .....              | 51                  | 2786            |
| Fifth sand (gas, 2790') ..... | 12                  | 2798            |
| Unrecorded to bottom .....    | 70                  | 2868            |

## Pressure test:

|                                    |                      |
|------------------------------------|----------------------|
| 1st $\frac{1}{2}$ minute, 165 lbs. | 3rd minute, 340 lbs. |
| 1st minute, 225 lbs.               | 4th minute, 360 lbs. |
| 2nd minute, 290 lbs.               |                      |

## A. T. Hibbs No. 1 Well Record (571).

Pawpaw district, 2 miles east of Basnett. Authority, Hope Natural Gas Company. Completed April 2, 1898.

| (Elevation, 1184' L-A.T.)   | Thickness.<br>Feet. | Total.<br>Feet. |
|---|---------------------|-----------------|
| Conductor .....   | 20                  | 20              |
| Unrecorded .....  | 296                 | 316             |
| Pittsburgh coal .....   | ...                 | 316             |
| Unrecorded .....  | 1298                | 1614            |
| Big Injun sand (light gas, 1711'; fair gas, 1717') .....  | 133                 | 1747            |
| Unrecorded .....  | 518                 | 2265            |
| Gantz sand and unrecorded .....   | 48                  | 2313            |
| Thirty-foot sand (fair gas) .....   | 30                  | 2343            |
| Unrecorded .....  | 252                 | 2595            |
| Fifth sand (gas, 2595') and unrecorded .....  | 35                  | 2530            |
| Lime, slate and shells to bottom .....  | 20                  | 2750            |
| 10" casing, 437'; 8 $\frac{1}{4}$ " casing, 1265'; 6 $\frac{3}{8}$ " casing, 1375'; 5 $\frac{1}{8}$ " cas<br>in, 1614'. |                     |                 |

## W. G. King No. 1791 Well Record (574).

Pawpaw district, 1.8 miles southeast of Fairview. Authority, Hope Natural Gas Company. Completed January 1, 1907.

| (Elevation, 972' L-A.T.)            | Thickness.<br>Feet. | Total.<br>Feet. |
|-------------------------------------|---------------------|-----------------|
| Conductor .....                     | 14                  | 14              |
| Unrecorded .....                    | 126                 | 140             |
| Coal, Mapletown (Sewickley) .....   | ...                 | 140             |
| Unrecorded .....                    | 102                 | 242             |
| Pittsburgh coal .....               | ...                 | 242             |
| Unrecorded .....                    | 1268                | 1510            |
| Big Lime .....                      | 60                  | 1570            |
| Big Injun sand (gas, 1690') .....   | 230                 | 1800            |
| Unrecorded .....                    | 315                 | 2115            |
| Berea sand .....                    | 30                  | 2145            |
| Unrecorded .....                    | 15                  | 2160            |
| Fifty-foot sand .....               | 55                  | 2215            |
| Unrecorded .....                    | 35                  | 2250            |
| Thirty-foot sand (gas, 2260') ..... | 25                  | 2275            |
| Unrecorded .....                    | 95                  | 2370            |
| Gordon Stray sand .....             | 25                  | 2395            |
| Unrecorded .....                    | 30                  | 2425            |
| Gordon sand .....                   | 20                  | 2445            |
| Unrecorded (no Fourth sand) .....   | 190                 | 2635            |
| Bayard sand (gas in top) .....      | 22                  | 2657            |
| Unrecorded to bottom .....          | 88                  | 2745            |

Several widely scattered wells have been drilled on the east side of the axis of the Lambert syncline in Pawpaw, the most of which are gassers, since this portion of the district occupies a relatively high structural level. The four following records give a large fund of information on this region:

### Ulysses M. Price No. 1 Well Record (577).

Pawpaw district, 1.1 miles southeast of McCurdyville. Authority, Hope Natural Gas Company. Completed Aug. 23, 1904.

|  | Thickness. Total |       |
|--|------------------|-------|
|  | Feet.            | Feet. |
| Unrecorded .....   | 711              | 711   |
| Coal, Mapletown (Sewickley) .....  | ..               | 711   |
| Unrecorded .....   | 89               | 800   |
| Coal, Pittsburgh .....   | ..               | 800   |
| Unrecorded .....   | 1310             | 2110  |
| Red rock and unrecorded .....  | 17               | 2127  |
| Big Injun sand (light gas, 2165'; strong gas, 2228')<br>and unrecorded ..... | 823              | 2950  |
| Gordon sand and unrecorded .....   | 50               | 3000  |
| Fourth sand and unrecorded .....   | 210              | 3210  |
| Bayard sand (oil) and unrecorded to bottom .....                             | 235              | 3445  |
| 6% casing, 2060'; 5 $\frac{1}{4}$ " casing, 2411'.                           |                  |       |

The above well had an initial oil production of 7 to 8 bbls. daily from the Bayard.

### Jonathan Eddy No. 1 Well Record (578).

Pawpaw district, 1.1 mile S 30° E of McCurdyville. Authority, Hope Natural Gas Company.

| (Elevation, 1050' B-A.T.)   | Thickness. Total |       |
|---|------------------|-------|
|   | Feet.            | Feet. |
| Conductor .....   | 20               | 20    |
| Unrecorded .....  | 370              | 390   |
| Pittsburgh coal .....   | ..               | 390   |
| Unrecorded .....  | 1290             | 1680  |
| Big Injun sand (gas, 1685', 1787') and unrecorded to bot-<br>tom .....    | 131              | 1811  |
| 7% casing, 435'; 6% casing, 1040', 4% casing, 1638'; 2" tubing,<br>1740'. |                  |       |

Shot July 30, 1901, with 10 quarts of nitro-glycerine.

The above well starts flush with the Elm Grove limestone, and it has an initial gas production of 10,000,000 cu. ft. daily.

**Alpheus (J. L.) Fluharty No. 1 Well Record (581).**

Pawpaw district, 0.7 mile northeast of Gray's Flat. Authority, Hope Natural Gas Company. Completed Nov. 2, 1910.

| (Elevation, 1030' B-A.T.)  | Thickness. Total. |       |
|--|-------------------|-------|
|  | Feet.             | Feet. |
| Conductor .....  | 16                | 16    |
| Unrecorded .....   | 322               | 338   |
| Pittsburgh coal (steel line measurement).....                              | 8                 | 346   |
| Unrecorded .....   | 888               | 1234  |
| Second Salt sand (water, 1272').....                                       | 128               | 1362  |
| Unrecorded .....   | 232               | 1594  |
| Big Lime .....   | 69                | 1663  |
| Big Injurn sand (gas, 1750'-1754') steel line measurement.                 | 195               | 1858  |
| Squaw sand.....  | 54                | 1912  |
| Unrecorded .....   | 250               | 2162  |
| Berea, Gantz and Fifty-foot sands (steel line measurement)                 | 150               | 2312  |
| Unrecorded .....   | 48                | 2360  |
| Thirty-foot sand (steel line measurement).....                             | 32                | 2392  |
| Unrecorded .....   | 161               | 2553  |
| Gordon sand (steel line measurement) .....                                 | 29                | 2582  |
| Unrecorded .....   | 100               | 2682  |
| Fifth sand (steel line measurement) .....                                  | 34                | 2716  |
| Unrecorded to botton (steel line measurement) .....                        | 349               | 3065  |
| 10" casing, 376'; 8¼" casing, 1346'; 6½" casing, 1667'; 5⅝" casing, 2556'. |                   |       |

Shot Nov. 10, 1910, with 100 quarts; shell 5"x25'; top of shell, 1746'.

Test before shot  $\frac{1}{10}$  water in 1" pipe. Test 2 hours after shot, 10/10 water in 1" pipe 8¼"x5⅝" Dresser Packer at 1667'

**J. W. Williams No. 1 Well Record (585).**

Pawpaw district, 1.4 miles west of Arnettville. Authority, West Virginia Traction & Electric Company. Completed Aug. 12, 1911.

| (Elevation, 1199' L-A. T.)                     | Thickness. Total. |       |
|--|-------------------|-------|
|  | Feet.             | Feet. |
| Conductor .....                                | 14                | 14    |
| Slate, sand, lime, no coal .....               | 336               | 350   |
| Sand, (Sewickley) .....                        | 40                | 390   |
| Sewickley coal .....                           | 5                 | 395   |
| Lime .....                                     | 40                | 435   |
| Slate .....                                    | 53                | 488   |
| Pittsburgh coal .....                          | 7                 | 495   |
| Slate, black, lime, sand, and no coal .....    | 10                | 505   |
| Lime, slate, sand no coal .....                | 325               | 830   |
| Moundsville sand (gas, 860').....              | 50                | 880   |
| Slate and shells, lime and sand, no coal ..... | 455               | 1235  |
| Gas sand (gas, 1252') .....                    | 40                | 1275  |
| Slate and shells .....                         | 35                | 1310  |
| First Salt sand .....                          | 52                | 1362  |
| Slate and shells .....                         | 20                | 1382  |
| Lime .....                                     | 16                | 1398  |
| Salt sand (water, 1481').....                  | 106               | 1504  |
| Slate and shells .....                         | 58                | 1562  |
| Maxton sand .....                              | 18                | 1580  |
| Lime, red .....                                | 110               | 1690  |

|   | Thickness. | Total. |
|---|------------|--------|
|   | Feet.      | Feet.  |
| Slate and shells .....  | 57         | 1747   |
| Little Lime .....   | 25         | 1772   |
| Pencil cave .....   | 10         | 1782   |
| Big Lime .....  | 74         | 1856   |
| Big Injun sand (gas, 1951') .....                             | 116        | 1972   |
| Slate and shells, white .....                                 | 85         | 2057   |
| Sand, (Squaw) .....   | 65         | 2122   |
| Slate and shells, black .....                                 | 93         | 2215   |
| Berea Grit .....  | 28         | 2243   |
| Slate and shale, white .....                                  | 103        | 2346   |
| Gantz sand (gas, 2366') .....                                 | 33         | 2379   |
| Slate, black .....  | 9          | 2388   |
| Fifty-foot sand .....   | 118        | 2506   |
| Slate, red .....  | 18         | 2524   |
| Thirty-foot sand .....  | 12         | 2536   |
| Slate and shells, red .....                                   | 29         | 2565   |
| Slate and shells, black .....                                 | 55         | 2620   |
| Slate and shells, red .....                                   | 63         | 2683   |
| Shells .....  | 3          | 2686   |
| Slate, black .....  | 5          | 2691   |
| Gordon Stray sand .....                                       | 4          | 2695   |
| Slate, black .....  | 12         | 2707   |
| Gordon sand .....   | 6          | 2713   |
| Slate, black .....  | 32         | 2745   |
| Lime .....  | 20         | 2765   |
| Fourth sand .....   | 12         | 2777   |
| Slate, black .....  | 28         | 2805   |
| Sand, brown .....   | 22         | 2627   |
| Slate, white .....  | 34         | 2861   |
| Sand, white .....   | 6          | 2867   |
| Slate, black .....  | 4          | 2871   |
| Fifth sand .....  | 51         | 2922   |
| Slate, white and unrecorded to bottom .....                   | 105        | 3025   |
| 10" casing, 517' 2"; 8¼" casing, 1496' 3"; 6½" casing, 1811'. |            |        |

On Little Pawpaw creek north from Stafford two very shallow wells have been drilled for gas. The **Wm. R. Clayton No. 1 well (587)**, located 0.7 mile north of Stafford, was drilled to a depth of only 40 feet in October, 1909. A pay of gas was struck at a depth of 30 feet, and another at 40 feet in what appears to be the Arnoldsburg sandstone, since the well mouth is about 125 feet above the Sewickley coal. According to Mrs. Clayton, sufficient gas was obtained to furnish fuel for 2 heating stoves, 1 cook stove and 4 lights. No trouble is experienced in freezing of pipes, and the volume appeared as strong in September, 1911, as at first.

The **New Central Coal Co. No. 3 (588) well**, located one-fourth mile north of Stafford, obtained its gas in the Sewickley coal at a depth of 125 feet, according to G. S. Phillips.

Superintendent. The rock pressure was 11 pounds to the square inch. Two other shallow wells have been drilled by this company, and the three, in September, 1911, had been furnishing gas for 6 years for fuel and lights in the dwelling houses of the officials of the corporation.

**Prospective Oil and Gas Areas, Pawpaw District.**—The western half of Pawpaw has been quite thoroughly tested for oil and gas, but the results of test wells in the eastern portion have not been so encouraging. There are, however, a few scattered areas that would warrant further search for these hydro-carbons. (1) That territory lying eastward from Bassett to the dividing ridge on the east side of Laurel run, appears favorable for gas in the Big Injun and deeper sands; (2) that, in the northeast corner of the district on the waters of Chunk run for Bayard sand oil; and (3) that, on the waters of Little Pawpaw and Minister's run northward from the mouth of the latter stream and southward from the 700-foot contour of Pittsburgh coal as outlined on Map II for oil in the Fifth and Bayard, situated as it is on a marked structural terrace.

### ***Lincoln District.***

Lincoln district lies immediately southwest from Pawpaw district and its area is traversed by three structural folds; viz., the Wolf Summit and Mooresville anticlines and the Shinnston syncline. Located as it is at a high structural level immediately southeast of the Mannington oil field, the greatest gas pools of Marion county are included within its borders, especially in the southern half of its area. The Mt. Morris-Fairview oil belt extends in a northeast-southwest direction entirely across its northwest corner. The oil and gas development therein will now be discussed roughly from northwest to southeast across the district.

About 100 wells, 90 to 95 per cent of which were oil producers, have been drilled in the Mt. Morris-Fairview oil belt within the boundaries of Lincoln. The seven following records from wells scattered throughout the field give much data of economic interest:

## William Wallace No. 1 Well Record (591).

Lincoln district, 2.1 miles southwest of Fairview. Authority.  
Hope Natural Gas Company.

| (Elevation, 1110' B-A. T.)                              | Thickness. Total. |       |
|---|-------------------|-------|
|   | Feet.             | Feet. |
| Conductor .....   | 18                | 18    |
| Slate, white and soft.....                              | 80                | 98    |
| Sand, brown, soft, (Mannington).....                    | 27                | 125   |
| Slate, white and soft.....                              | 15                | 140   |
| Sand, Waynesburg, white, sharp (water all through)..... | 57                | 197   |
| Coal, Waynesburg.....                                   | 2                 | 199   |
| Slate, white and soft.....                              | 3                 | 202   |
| Limestone, gray, hard.....                              | 5                 | 207   |
| Slate, white and hard.....                              | 15                | 222   |
| Limestone, gray, hard.....                              | 10                | 232   |
| Slate, white, hard.....                                 | 20                | 252   |
| Limestone, gray, hard.....                              | 20                | 272   |
| Slate, white, hard.....                                 | 10                | 282   |
| Limestone, gray, hard.....                              | 20                | 302   |
| Slate, white, hard.....                                 | 20                | 322   |
| Limestone, gray and hard.....                           | 30                | 352   |
| Slate, gray and hard.....                               | 20                | 372   |
| Limestone, gray and hard.....                           | 20                | 392   |
| Slate, gray and hard.....                               | 10                | 402   |
| Limestone.....  | 30                | 432   |
| Slate, white, hard.....                                 | 10                | 442   |
| Sand, white, soft.....                                  | 28                | 470   |
| Coal, Mapletown (Sewickley).....                        | 10                | 480   |
| Limestone, gray and hard.....                           | 30                | 510   |
| Slate, white and soft.....                              | 15                | 525   |
| Limestone, gray, hard.....                              | 20                | 545   |
| Slate, gray, hard.....                                  | 15                | 560   |
| Limestone, gray, hard.....                              | 20                | 580   |
| Slate, black.....                                       | 10                | 590   |
| Coal, Pittsburgh.....                                   | 11                | 601   |
| Slate, white.....                                       | 20                | 621   |
| Limestone.....  | 10                | 631   |
| Slate, white.....                                       | 10                | 641   |
| Sand, white, hard.....                                  | 15                | 656   |
| Limestone.....  | 10                | 666   |
| Slate.....  | 10                | 676   |
| Limestone, gray.....                                    | 25                | 701   |
| Slate, gray.....  | 10                | 711   |
| Limestone.....  | 20                | 731   |
| Slate.....  | 20                | 751   |
| Red rock.....   | 10                | 761   |
| Slate, white and soft.....                              | 40                | 801   |
| Red rock.....   | 65                | 866   |
| Limestone, gray, hard.....                              | 10                | 876   |
| Slate, white and soft.....                              | 24                | 900   |
| Red rock.....   | 40                | 940   |
| Sand, dark, soft.....                                   | 25                | 965   |
| Slate, white, soft.....                                 | 135               | 1100  |
| Slate, dark.....  | 30                | 1130  |
| Sand, dark.....   | 10                | 1140  |
| Limestone, dark, hard.....                              | 20                | 1160  |

|   | Thickness.       | Total |
|---|------------------|-------|
|   | Feet.            | Feet. |
| Slate, white, soft.....                     | 5                | 1165  |
| Sand, white (Upper and Lower Freeport)..... | 170              | 1335  |
| Slate and limestone.....                    | 50               | 1385  |
| Sand, white.....                            | 52               | 1437  |
| Slate, very soft.....                       | 133              | 1570  |
| Salt sand.....                              | 15               | 1585  |
| Slate.....                                  | 25               | 1610  |
| Sand.....                                   | 20               | 1630  |
| Slate.....                                  | 35               | 1665  |
| Limestone.....                              | 20               | 1685  |
| Slate.....                                  | 25               | 1710  |
| Sand, black.....                            | 25               | 1735  |
| Red rock.....                               | 60               | 1795  |
| Limestone.....                              | 20               | 1815  |
| Red rock.....                               | 7                | 1822  |
| Limestone (Big Lime).....                   | 90               | 1912  |
| Sand, white.....49                          | } Big Injun..... | 148   |
| Limestone, white, hard....10.5              |                  |       |
| Slate, dark, hard.....11                    |                  |       |
| Sandstone, white very hard.14               |                  |       |
| Sand, hard..... 8.5                         |                  |       |
| Sand, coarse..... 3                         |                  |       |
| Slate, red..... 1                           |                  |       |
| Sandstone, hard, white.....24               |                  |       |
| Slate.....19                                |                  |       |
| Sand, hard..... 8                           |                  |       |
| Sand and shells to bottom.....              |                  | 2060  |
| 10 1/2" casing, 199'; —" casing, 1799'.     |                  |       |

**W. M. Billingslea No. 1 Well Record (592).**

Lincoln district, 1.4 miles N 30° E of McClellan. Authority, South Penn Oil Company. Completed August 31, 1896.

|   | Thickness. | Total |
|---|------------|-------|
|   | Feet.      | Feet. |
| (Elevation, 1095' B-A. T.)                                    |            |       |
| Unrecorded.....   | 542        | 542   |
| Pittsburgh coal.....  |            | 542   |
| Unrecorded.....   | 1308       | 1850  |
| Big Injun sand (oil pay, 1952') and unrecorded to bottom..    | 125        | 1975  |
| 10" casing, 572'; 8 1/4" casing, 1332'; 6 1/2" casing, 1845'. |            |       |

Shot Mar. 10, 1897, with 16 quarts; January, 1898, with 24 quarts; Jan. 21, 1899, with 30 quarts; and Feb. 14, 1908, with 40 quarts in 2-20 quart shells; top of first 1952'; top of second, 1949'.

**Benjamin Huffman No. 3 Well Record (594).**

Lincoln district, 0.4 mile northwest of McClellan. Authority, South Penn Oil Company.

|                                    | Thickness. | Total |
|------------------------------------|------------|-------|
|                                    | Feet.      | Feet. |
| Conductor.....                     | 16         | 16    |
| Unrecorded (water well, 100')..... | 528        | 544   |
| Pittsburgh coal.....               | 8          | 552   |
| Unrecorded.....                    | 1255       | 1807  |



|   | Thickness. Total |       |
|---|------------------|-------|
|   | Feet.            | Feet. |
| Big Lime .....  | 80               | 1887  |
| Big Injun sand (oil, 1961') and unrecorded to bottom.....   | 123              | 2010  |
| 10" casing, 176'; 8¼" casing, 994'; 6½" casing, 1887'.<br>Shot June 1899, with 12 quarts; 4' shell, top, 1960'.<br>Shot Dec. 3, 1901, with 15 quarts, 6' shell, top, 1960'. |                  |       |

### A. O. Talkington No. 2 Well Record (596).

Lincoln district, 1.6 miles north of Downs. Authority South Penn Oil Company. Completed Aug. 3, 1891.

|  | Thickness. Total |       |
|--|------------------|-------|
|  | Feet.            | Feet. |
| Conductor .....  | 24               | 24    |
| Unrecorded .....   | 541              | 565   |
| Pittsburgh coal.....   | 10               | 575   |
| Unrecorded .....   | 1295             | 1370  |
| Big Lime .....   | 40               | 1910  |
| Big Injun sand (first oil pay, 2012'-2044') and unrecorded to bottom.....  | 130              | 2040  |
| 10" casing, 196'; 8¼" casing, 1105'; 6½" casing, 1558'; 5½" casing, 1920'.<br>Shot Aug. 19, 1891, with 6 quarts; 4' shell.<br>Shot Nov. 26, 1894, with 12 quarts; 10' shell, top, 2012'. |                  |       |

The above well starts 15 feet above the Washington coal, according to Reger.

The detailed log of the **Rezin Amos No. 1 well (599)**, located on Mod run, 1.3 miles north of Downs is published in full in connection with the section for the latter place, page 134. It was an oil producer from the Big Injun sand.

### N. Beaty No. 17 Well Record (603).

Lincoln district, 1 mile northwest of Downs. Authority, McCune Oil Company.

|  | Thickness. Total |       |
|--|------------------|-------|
|  | Feet.            | Feet. |
| (Elevation, 1170' B-A. T.)   |                  |       |
| Unrecorded .....   | 600              | 600   |
| Pittsburgh coal.....   |                  | 600   |
| Unrecorded (first oil pay in Big Injun, 2029'; second pay 2036') ..... | 1900             | 1500  |
| Gantz sand and unrecorded.....   | 30               | 1530  |
| Fifty-foot sand and unrecorded.....                                    | 320              | 2850  |
| Fourth sand (gas, 2858') and unrecorded.....                           | 140              | 2990  |
| Bayard sand (gas, 2995') and unrecorded to bottom.....                 | 70               | 3060  |

**John Eagan No. 3 Well Record (605).**

Lincoln district, 0.9 mile north of Downs. Authority, Leonard Brown & Company.

|  | Thickness. Total. |       |
|--|-------------------|-------|
|  | Feet.             | Feet. |
| (Elevation, 1310' B-A. T.)   |                   |       |
| Unrecorded .....   | 715               | 715   |
| <b>Pittsburgh coal</b> .....   |                   | 715   |
| Unrecorded and Injun sand (oil show, 2162'; second measure, 2182').....                  | 1486              | 2201  |
| Unrecorded .....   | 441               | 2645  |
| <b>Fifty-foot sand and unrecorded</b> .....  | 302               | 2947  |
| <b>Fourth sand (oil, 2950')</b> .....  | 23                | 2970  |
| Unrecorded .....   | 10                | 2980  |
| <b>Fourth sand and unrecorded</b> .....  | 144               | 3124  |
| <b>Bayard sand (gas, 3125')</b> .....  | 12                | 3136  |
| 8 $\frac{1}{4}$ " casing, 1243'; 6 $\frac{1}{2}$ " casing, 2057'; rock pressure 900 lbs. |                   |       |

**Festus Downs No. 4 Well Record (606).**

Lincoln district, 0.5 mile north of Downs. Authority, Leonard Brown & Company.

|   | Thickness. Total. |       |
|---|-------------------|-------|
|   | Feet.             | Feet. |
| (Elevation, 1100' B-A. T.)  |                   |       |
| Unrecorded .....  | 485               | 485   |
| <b>Pittsburgh coal</b> .....  |                   | 485   |
| Unrecorded (first oil pay, 1985') and <b>Big Injun sand</b> .....   | 1475              | 1960  |
| Unrecorded .....  | 457               | 2417  |
| <b>Fifty-foot sand</b> .....  | 46                | 2463  |
| Unrecorded .....  | 255               | 2718  |
| <b>Fourth sand (oil, 2727') and unrecorded to bottom</b> .....  | 17                | 2735  |
| 6 $\frac{1}{2}$ " casing, 1484'; sand liner in pencil cave, 1818'.<br>"Initial production, 70 bbls. daily." |                   |       |

Along the crests and down the slopes of the Wolf Summit and Mooresville anticlines about 250 gas wells have been drilled within the boundaries of Lincoln district. The nine following records from wells scattered throughout this great field show that the Big Injun, Fifty-foot, Thirty-foot, Fourth, Fifth and Bayard sands are the main gas producing horizons:

**A. B. Morgan No. 1 Well Record (622).**

Lincoln district, 0.8 mile southeast of Farmington. Authority, Carnegie Natural Gas Company. Completed Nov. 20, 1911.

|                                      | Thickness. Total. |       |
|--------------------------------------|-------------------|-------|
|                                      | Feet.             | Feet. |
| (Elevation, 1150' B-A.T.)            |                   |       |
| Unrecorded .....                     | 470               | 470   |
| <b>Coal, Pittsburgh</b> .....        | 9                 | 479   |
| Unrecorded .....                     | 1365              | 1844  |
| <b>Big Injun sand</b> .....          | 111               | 1955  |
| Unrecorded .....                     | 901               | 2856  |
| <b>Fifth sand (gas, 2872')</b> ..... | 23                | 2879  |
| Unrecorded to bottom.....            | 37                | 2916  |
| 40 lbs. pressure in 2" tubing.       |                   |       |

The gas pay is evidently in the Fifth sand, since this horizon belongs about 1,000 feet below the top of the Big Injun, while the Bayard belongs about 1100 feet below the same datum plane. In this portion of Marion county, the old Pittsburgh coal—Bayard interval (2400 feet) does not continue to hold good owing to the increased thickness of the Pottsville and Mauch Chunk series.

### John W. Criss No. 1 Well Record (624).

Lincoln district, 1.6 miles southwest of Farmington. Authority, Carnegie Natural Gas Company. Completed July 14, 1906.

| (Elevation, 975' B-A. T.)   | Thickness.<br>Feet.     | Total.<br>Feet. |
|---|-------------------------|-----------------|
| Unrecorded .....  | 275                     | 275             |
| Coal, Pittsburgh.....   | 9                       | 284             |
| Unrecorded .....  | 1372                    | 1656            |
| Big Injun sand.....   | 140                     | 1796            |
| Unrecorded .....  | 683                     | 2479            |
| Gordon sand.....  | 25                      | 2505            |
| Unrecorded .....  | 65                      | 2573            |
| Fourth sand.....  | 22                      | 2595            |
| Unrecorded .....  | 100                     | 2695            |
| Fifth sand gas, 2697' and 2703').....   | 19                      | 2714            |
| 6 $\frac{1}{2}$ " casing, 1630'; 5 $\frac{1}{8}$ " casing, 1855'; 3" tubing, 2714'. |                         |                 |
| First Pressure test in 3" tubing:   |                         |                 |
| 1st minute, 230 lbs.  | 4th minute, 490 lbs.    |                 |
| 2nd minute, 340 lbs.  | 5th minute, 500 lbs.    |                 |
| 3rd minute, 425 lbs.  | Rock pressure, 640 lbs. |                 |

The H. L. Sturm No. 1 well (626), completed in 1905 and located 1.2 miles southeast of Downs, gaged 2.4 inches mercury in 5 3/16" casing, from the Fifth sand, according to data given Mr. Reger, being equivalent to 5,400,000 cu. ft. of gas daily.

### James Morgan (Silas Stark) No. 1894 Well Record (627).

Lincoln district, 1.1 miles northwest of Annabelle. Authority, Philadelphia Company. Completed June 28, 1906.

| (Elevation, 1112' L-A. T.)                         | Thickness.<br>Feet. | Total.<br>Feet. |
|--|---------------------|-----------------|
| Unrecorded .....                                   | 302                 | 302             |
| Mapletown (Redstone) coal and unrecorded.....      | 26                  | 328             |
| Pittsburgh coal.....                               |                     | 328             |
| Unrecorded .....                                   | 1205                | 1533            |
| Maxton sand (oil show).....                        | 77                  | 1610            |
| Unrecorded .....                                   | 70                  | 1680            |
| Big Injun sand (gas) and unrecorded to bottom..... | 33                  | 1713            |
| "Original minute pressure in Big Injun, 145 lbs."  |                     |                 |

**M. M. Martin No. 2121 Well Record (630).**

Lincoln district, 0.7 miles N 20° W of Bingamon. Authority, Philadelphia Company.

|   | Thickness. | Total. |
|---|------------|--------|
| (Elevation, 1045' B-A. T.)                | Feet.      | Feet.  |
| Unrecorded .....                          | 300        | 300    |
| Pittsburgh coal.....                      | 5          | 305    |
| Unrecorded .....                          | 85         | 1690   |
| Big Injun sand.....                       | 110        | 1800   |
| Unrecorded .....                          | 712        | 2512   |
| Fourth sand (gas, 2518'; oil, 2520')..... | 33         | 2545   |
| Unrecorded .....                          | 138        | 2683   |
| Fifth sand (gas, 2685').....              | 4          | 2687   |

**A. A. Parrish No. 805 Well Record (635).**

Lincoln district, 1 mile N 35° E of Annabelle. Authority, Hope Natural Gas Company.

|   | Thickness. | Total. |
|---|------------|--------|
| (Elevation, 1285' B-A. T.)                  | Feet.      | Feet.  |
| Unrecorded .....                            | 480        | 480    |
| Native coal (Sewickley).....                | 6          | 486    |
| Unrecorded .....                            | 114        | 600    |
| Pittsburgh coal.....                        | 8          | 608    |
| Unrecorded .....                            | 907        | 1515   |
| Salt sand (water, 1540'-1590').....         | 160        | 1675   |
| Unrecorded, (Maxton sand, shells only)..... | 190        | 1865   |
| Little Lime .....                           | 15         | 1880   |
| Pencil cave.....                            | 10         | 1890   |
| Big Lime.....                               | 81         | 1971   |
| Big Injun sand (gas, 2062'-2063').....      | 34         | 2105   |
| Unrecorded .....                            | 415        | 2520   |
| Fifty-foot sand.....                        | 80         | 2600   |
| Unrecorded (gas in Thirty-foot sand).....   | 195        | 2795   |
| Gordon Stray sand.....                      | 35         | 2830   |
| Unrecorded .....                            | 6          | 2836   |
| Gordon sand.....                            | 14         | 2850   |
| Unrecorded .....                            | 25         | 2875   |
| Fourth sand.....                            | 15         | 2890   |
| Unrecorded .....                            | 103        | 2993   |
| Fifth sand.....                             | 12         | 3005   |
| Unrecorded to bottom.....                   | 50         | 3055   |

8 $\frac{1}{4}$ " casing, 1628'; 6 $\frac{1}{2}$ " casing, 1950'; 5 $\frac{1}{8}$ " casing, 2365'.

**W. S. Parrish No. 2197 Well Record (639).**

Lincoln district, 0.7 mile N 30° W of Festus. Authority, Hope Natural Gas Company.

|                                 | Thickness. | Total. |
|---------------------------------|------------|--------|
| (Elevation, 1240' B-A. T.)      | Feet.      | Feet.  |
| Unrecorded .....                | 453        | 453    |
| Mapletown (Sewickley) coal..... | 4          | 457    |
| Unrecorded .....                | 113        | 570    |
| Pittsburgh coal.....            | 7          | 577    |

|  | Thickness.<br>Feet. | Total<br>Feet. |
|--|---------------------|----------------|
| Unrecorded .....   | 1083                | 1460           |
| Salt sand (water, 1485'-1515') .....   | 160                 | 1620           |
| Unrecorded .....   | 236                 | 1856           |
| Little Lime .....  | 10                  | 1866           |
| Pencil cave .....  | 6                   | 1872           |
| Big Lime .....   | 93                  | 1965           |
| Big Injun sand .....   | 75                  | 2040           |
| Unrecorded .....   | 455                 | 2495           |
| Fifty-foot sand (gas, 2504') .....   | 60                  | 2555           |
| Unrecorded .....   | 10                  | 2565           |
| Thirty-foot sand .....   | 35                  | 2600           |
| Unrecorded (Gordon Stray sand, shells only) .....  | 167                 | 2767           |
| Gordon sand .....  | 25                  | 2792           |
| Unrecorded .....   | 13                  | 2805           |
| Fourth sand .....  | 20                  | 2825           |
| Unrecorded .....   | 132                 | 2957           |
| Fifth sand (gas, 2966') and unrecorded to bottom .....   | 75                  | 3032           |
| 10" casing, 622'; 8" casing, 1495'; 6½", 1900'; 5" casing, 2770'; 2" tubing, 3032'.                  |                     |                |
| "Rock pressure in Fifty-foot sand, 640 lbs.; rock pressure in Fifth sand, 250 lbs. per square inch." |                     |                |

#### A. Martin No. 2165 Well Record (640).

Lincoln district, at Annabelle. Authority, Hope Natural Gas Company. Completed May 19, 1911.

| (Elevation, 1155' B-A. T.)                            | Thickness.<br>Feet. | Total<br>Feet. |
|---|---------------------|----------------|
| Unrecorded .....                                      | 280                 | 280            |
| Mapletown (Sewickley) coal .....                      | 5                   | 285            |
| Unrecorded .....                                      | 115                 | 400            |
| Pittsburgh coal .....                                 | 7                   | 407            |
| Unrecorded .....                                      | 893                 | 1300           |
| Salt sand (water, 1310') .....                        | 180                 | 1480           |
| Unrecorded, (Maxton sand, lime shells only) .....     | 200                 | 1680           |
| Little Lime .....                                     | 12                  | 1692           |
| Pencil cave .....                                     | 8                   | 1700           |
| Big Lime .....  | 88                  | 1788           |
| Big Injun sand (gas, 1830') .....                     | 72                  | 1860           |
| Unrecorded .....                                      | 930                 | 2790           |
| Fifth sand (gas, 2790') .....                         | 17                  | 2807           |
| Unrecorded to bottom .....                            | 155                 | 2962           |
| 10" casing, 450'; 6" casing, 1750'; 5" casing, 2567'. |                     |                |

#### E. H. Stevens No. 2138 Well Record (642).

Lincoln district, 0.5 mile east of Sturm's Mill. Authority, Philadelphia Company.

| (Elevation, 1033' L-A. T.)       | Thickness.<br>Feet. | Total<br>Feet. |
|----------------------------------|---------------------|----------------|
| Unrecorded .....                 | 70                  | 70             |
| Mapletown (Sewickley) coal ..... | 3                   | 73             |
| Unrecorded .....                 | 117                 | 190            |
| Pittsburgh coal .....            | 4                   | 194            |

|                              | Thickness.<br>Feet. | Total<br>Feet. |
|------------------------------|---------------------|----------------|
| Unrecorded .....             | 1436                | 1630           |
| Big Injun sand.....          | 50                  | 1680           |
| Unrecorded .....             | 730                 | 2410           |
| Gordon sand.....             | 44                  | 2454           |
| Unrecorded .....             | 136                 | 2590           |
| Fifth sand (gas, 2595')..... | 10                  | 2600           |
| Unrecorded to bottom.....    | 13                  | 2613           |

**Marvin Tetrick (Eleon Straight) No. 2148 Well Record (651).**

Lincoln district, 1.4 miles west of Worthington. Authority, Philadelphia Company. Completed May 4, 1907.

| (Elevation, 1220' B-A. T.)       | Thickness.<br>Feet. | Total<br>Feet. |
|----------------------------------|---------------------|----------------|
| Unrecorded .....                 | 348                 | 348            |
| Mapletown (Sewickley) coal.....  | ...                 | 348            |
| Unrecorded .....                 | 112                 | 460            |
| Pittsburgh coal.....             | ...                 | 460            |
| Unrecorded .....                 | 1403                | 1863           |
| Big Injun sand.....              | 90                  | 1953           |
| Unrecorded .....                 | 637                 | 2690           |
| Gordon sand.....                 | 14                  | 2704           |
| Unrecorded .....                 | 134                 | 2838           |
| Shells (gas) and unrecorded..... | 7                   | 2845           |
| Fifth sand (gas).....            | 10                  | 2855           |
| Unrecorded to bottom.....        | 26                  | 2881           |

"Original minute pressure, 55 lbs.; rock pressure, 865 lbs."

The following wells in this region were published in Vol. I(A) of the State Survey Reports:

| No. on<br>Map II. | Name of Well.            | Location.                | Page of<br>Vol. I(A). |
|-------------------|--------------------------|--------------------------|-----------------------|
| 610               | Hunter Atha No. 1.....   | On Dunkard Mill run....  | 155                   |
| 612               | Jack Connor No. 1.....   | On Dunkard Mill run....  | 154                   |
| 615               | E. W. Hamilton No. 1.... | Downs, 1.7 miles NE of.. | 155                   |

No. 610 in the above table was a Bayard sand gasser with a rock pressure of 1100 lbs. to the sq. in. The 1st minute pressure was 200 lbs.; the 2nd, 350 lbs.; and the 16th, 1060 lbs.

No. 612 was a Bayard gasser, having a pressure for the 1st minute of 275 lbs. to the sq. in.; the 2nd, 440 lbs.; the 5th, 740 lbs.; the 8th, 900 lbs.; the 10th, 935 lbs.; and the 15th, 950 lbs.

No. 615 had gas pays in the Big Injun, Fifty-foot, Fourth and Bayard sands.

**Prospective Oil and Gas Areas, Lincoln District.**—Lincoln district has been quite thoroughly drilled in its southern half for gas, but in the northern portion there remains a large acreage that both by structure and development warrants the drilling of more wells for gas. (1) That on the waters of

Dunkard Mill and Davy runs southward from Upton to Buffalo creek appears favorable for gas in the Big Injun and deeper sands; (2) that, along the Clarksburg pike southwestward from Monongah, for several more gassers; and (3) that, southward from Sturm's Mill on the head of Long run, for a half dozen more gas wells.

### *Fairmont District.*

Fairmont district occupies that portion of Marion county lying west of the Monongahela river, south of Fawpaw district and east of Lincoln district; hence, its area, with the exception of a narrow strip along the extreme western border, lies in the Lambert synclinal basin. The Mooresville anticline traverses in a north and south direction the western point of the district. Only seven wells, four of which were dry holes, have been drilled therein. The three producers are gassers along the western border.

The following is the record of a dry hole down near the axis of the Lambert syncline:

#### **Lewis Hall No. 1 Well Record. (665).**

Fairmont district, 1.4 miles N 20° W of Barrackville. Authority, Philadelphia Company. Completed in 1911.

| (Elevation, 1065' B-A. T.)         | Thickness. Total |       |
|------------------------------------|------------------|-------|
|                                    | Feet.            | Feet. |
| Clay .....                         | 13               | 13    |
| Bluff sand.....                    | 45               | 58    |
| Slate, dark.....                   | 67               | 125   |
| Lime .....                         | 150              | 275   |
| Slate, dark.....                   | 25               | 300   |
| Coal, Mapletown (Sewickley).....   | 5                | 305   |
| Lime (steel line measurement)..... | 112              | 417   |
| Pittsburgh coal.....               | 9                | 426   |
| Lime .....                         | 20               | 446   |
| Slate and shell.....               | 135              | 581   |
| Red rock.....                      | 40               | 621   |
| Lime .....                         | 94               | 715   |
| Slate, dark.....                   | 70               | 785   |
| Sand, (Moundsville) .....          | 20               | 805   |
| Slate, dark.....                   | 80               | 885   |
| Little Dunkard sand.....           | 40               | 925   |
| Slate and shell.....               | 225              | 1150  |
| Sand, white.....                   | 20               | 1170  |
| Slate, dark.....                   | 50               | 1220  |
| First Salt sand.....               | 55               | 1275  |

|  | Thickness.<br>Feet. | Total.<br>Feet. |
|--|---------------------|-----------------|
| Slate .....  | 50                  | 1325            |
| Second Salt sand.....                                      | 115                 | 1440            |
| Slate .....  | 70                  | 1510            |
| Red rock.....  | 60                  | 1570            |
| Slate .....  | 70                  | 1640            |
| Lime .....   | 15                  | 1655            |
| Red rock.....  | 20                  | 1675            |
| Little Lime.....   | 15                  | 1690            |
| Pencil, black.....   | 6                   | 1696            |
| Big Lime.....  | 79                  | 1775            |
| Big Injun, white, hard (steel line measurement).....       | 95                  | 1870            |
| Slate, black.....  | 70                  | 1940            |
| Sand, white, (Squaw).....                                  | 60                  | 2000            |
| Slate and shell.....                                       | 254                 | 2254            |
| Sand, (Gantz) white and hard (steel line measurement)..    | 41                  | 2295            |
| Slate and shell.....                                       | 188                 | 2483            |
| Thirty-foot sand, white and hard (steel line measurement). | 20                  | 2503            |
| Red rock.....  | 22                  | 2525            |
| Slate and shale.....                                       | 81                  | 2606            |
| Gordon sand, white and hard (steel line measurement)..     | 15                  | 2621            |
| Slate, dark, soft.....                                     | 46                  | 2667            |
| Fourth sand, white, hard.....                              | 20                  | 2687            |
| Slate and shells, light.....                               | 72                  | 2759            |
| Fifth sand, dark, soft.....                                | 25                  | 2784            |
| Slate, white, soft.....                                    | 142                 | 2926            |
| Lime, white, hard.....                                     | 5                   | 2931            |
| Slate, white, soft, to bottom.....                         | 96                  | 3027            |

The detailed log of the **Eli M. Rex No. 1 well (664)**, located on Finch's run in the northern part of Fairmont district, is published on pages 152-154 of Vol. I(A) of the State Survey reports. This well reached a depth of 2498 feet below the Pittsburgh coal with out getting either oil or gas in paying quantity.

No information was obtained as to the dry holes (Nos. 670 and 671) in the vicinity of Barrackville.

**Prospective Oil and Gas Areas, Fairmont District.**—The results of drilling operations in this district have not been very encouraging, but there yet remains a considerable acreage that would justify more test wells for gas. (1) That portion lying on the waters of Davy run appears favorable for gas in the Big Injun and deeper sands; and (2) that southward from the main line of the Baltimore & Ohio Railroad and west of a meridian line through the Morgan-Billingslee Coal Test Well No. 8 (669), is prospective territory for gas at the same horizons.



**Winfield and Union Districts.**

About the same geologic and structure conditions prevail in Winfield and Union districts, Marion county, as mentioned on a preceding page for the eastern portions of Union, Morgan and Clinton districts, Monongalia, since, with the exception of a small acreage on the southeast border, their entire area lies along the steep western slope of the same great anticlinal fold; viz., Chestnut Ridge. The results of drilling therein have been very discouraging to the oil and gas operators. Twelve wells have been bored within their boundaries—7 in Winfield and 5 in Union—and only one light gasser has resulted. The developments will now be discussed from north to south across the districts:

**F. M. Meredith No. 1 Well Record (682).**

Winfield district, 2 miles northeast of Fairmont. Authority, Anthony Bowen.

| (Elevation, 1100' B-A.T.)                                   | Thickness. |             |
|---|------------|-------------|
|   | Feet.      | Total Feet. |
| Unrecorded .....  | 480        | 480         |
| Freeport (Brush Creek) coal .....                           | 8          | 488         |
| Unrecorded .....  | 14         | 502         |
| Big Dunkard sand (slight oil and gas show) .....            | 26         | 528         |
| Unrecorded .....  | 142        | 670         |
| Gas sand .....  | 62         | 732         |
| Unrecorded .....  | 3          | 735         |
| Salt sand (water, 735'; hole full at 788') .....            | 65         | 800         |
| Unrecorded .....  | 408        | 1208        |
| Big Lime .....  | 142        | 1410        |
| Big Injun sand (slight oil show) .....                      | 130        | 1540        |
| Unrecorded .....  | 400        | 1940        |
| Fifty-foot and Thirty-foot sand (oil show in Fifty-foot)... | 70         | 2010        |
| Unrecorded .....  | 353        | 2363        |
| Fifth sand (oil show; pebbles, 2383'-2390') .....           | 30         | 2393        |
| Unrecorded .....  | 57         | 2450        |
| Bayard sand .....   | 36         | 2486        |
| Unrecorded to bottom .....                                  | 4          | 2490        |

The Gordon, Gordon Stray and Fourth sands not well defined. Considered shelly and broken.

10" casing, 258'; 8¼" casing, 1275'.

The above record starts 68 feet by hand-level below the Pittsburgh coal, according to Reger.

The detailed log of the **Brent S. Jones No. 1 well (682A)**, located 1.5 miles due south of Smittown on the south bank

of Whiteday creek, is published on pages 151-152 of Vol. I(A) of the State Survey reports. This well starts 15 feet by hand-level below the Upper Freeport coal, hence the correlations of coals as published in that report should be corrected accordingly. The boring reached a depth of 3150 feet below the Pittsburgh coal, and penetrated the Elizabeth sand.

The detailed log of the **A. Boutlou No. 1 well (666)**, completed during 1912 and located on the south side of the river, 0.6 mile southwest of Rivesville, is published on page 143, in connection with the Montana Mines section.

### Vincent Heirs No. 2010 Well Record (683)

Winfield district, 0.6 mile east of Samaria. Authority, Hope Natural Gas Company. Completed Mar. 21, 1911.

| (Elevation, 1114' L-A.T.)                        | Thickness. | Total |
|--|------------|-------|
|  | Feet.      | Feet. |
| Unrecorded (conductor, 16 feet.)                 | 10         | 10    |
| Sand, (Upper Connoquenessing)                    | 54         | 64    |
| Coal, (Quakertown)                               | 7          | 71    |
| Gas sand, (Lower Connoquenessing)                | 49         | 120   |
| Unrecorded                                       | 5          | 125   |
| Sand, (Sharon)                                   | 75         | 200   |
| Red rock and lime                                | 90         | 290   |
| Unrecorded                                       | 20         | 310   |
| Sand, (Maxton) (6 bailers salt water 354')       | 50         | 360   |
| Unrecorded                                       | 20         | 380   |
| Sand (3 bailers water, 395')                     | 20         | 400   |
| Red rock   | 105        | 505   |
| Little Lime                                      | 20         | 525   |
| Pencil cave                                      | 15         | 540   |
| Red rock   | 6          | 546   |
| Big Lime   | 78         | 624   |
| Red rock   | 3          | 627   |
| Slate and shells                                 | 31         | 658   |
| Big Injun sand (gas at 728', 736', 738' to 748') | 142        | 800   |
| Unrecorded                                       | 5          | 805   |
| Squaw sand                                       | 32         | 837   |
| Gantz sand?                                      | 338        | 1175  |
| Sand, (Berea)                                    | 15         | 1190  |
| Unrecorded                                       | 5          | 1195  |
| Sand, (Gantz)                                    | 85         | 1280  |
| Unrecorded                                       | 33         | 1313  |
| Sand, (Thirty-foot)                              | 24         | 1337  |
| Unrecorded                                       | 14         | 1351  |
| Sand, (Stray)                                    | 14         | 1365  |
| Unrecorded                                       | 9          | 1374  |
| Sand   | 6          | 1380  |
| Unrecorded                                       | 50         | 1430  |
| Red rock   | 209        | 1639  |
| Sand, (Fifth)                                    | 17         | 1656  |

|  | Thickness. | Total |
|--|------------|-------|
|  | Feet.      | Feet. |
| Red rock .....                           | 61         | 1717  |
| Sand, (Bayard) .....                     | 11         | 1728  |
| Lime and slate, brown and gray .....     | 520        | 2248  |
| Lime and shale .....                     | 402        | 2650  |
| Sand shells, shale and gritty lime ..... | 150        | 2800  |
| Lime and shale .....                     | 50         | 2850  |
| Lime .....                               | 90         | 2940  |
| Slate and shells to bottom .....         | 460        | 3400  |

10" casing, 298'; 8¼" casing, 589'; 6½" casing, 2266'.

"Pressure test: 3/10 water on 2" opening, equivalent to 82,000 cu. ft. daily."

The above well record starts approximately 900 feet below the Pittsburgh coal horizon, nearly flush with the top of the Upper Connoquenessing sandstone, cropping at the well. The boring evidently penetrated Devonian rocks from 1190 to 3400 feet—2310 feet—probably stopping in the Hamilton shales.

### J. F. Vangilder No. 1 Well Record (688).

Union district, 1.6 miles east of Kingmont. Authority, George E. Miller & Company. Completed October 17, 1911.

|   | Thickness. | Total |
|---|------------|-------|
| (Elevation, 975' B-A.T.)                              | Feet.      | Feet. |
| Unrecorded .....                                      | 305        | 305   |
| Coal, (Brush Creek) .....                             | 3          | 308   |
| Unrecorded .....                                      | 71         | 379   |
| Dunkard sand .....                                    | 39         | 418   |
| Unrecorded .....                                      | 27         | 445   |
| Sand .....  | 50         | 495   |
| Unrecorded .....                                      | 21         | 516   |
| Gas sand .....  | 48         | 564   |
| Unrecorded .....                                      | 19         | 583   |
| Coal, (Lower Kittanning) .....                        | 7          | 590   |
| Unrecorded .....                                      | 31         | 621   |
| Sand, (II Cow Run) .....                              | 71         | 692   |
| Unrecorded .....                                      | 9          | 701   |
| Salt sand .....                                       | 169        | 870   |
| Unrecorded .....                                      | 30         | 900   |
| Limestone .....                                       | 30         | 930   |
| Unrecorded .....                                      | 243        | 1173  |
| Little Lime .....                                     | 16         | 1189  |
| Pencil cave .....                                     | 11         | 1200  |
| Big Lime .....  | 90         | 1290  |
| Big Injun sand (oil show, 1395'-1401') .....          | 122        | 1412  |
| Unrecorded .....                                      | 149        | 1561  |
| Sand, (Squaw) .....                                   | 13         | 1574  |
| Unrecorded .....                                      | 226        | 1800  |
| Fifty-foot sand (not extra good, but no breaks) ..... | 62         | 1862  |
| Unrecorded .....                                      | 8          | 1870  |
| Thirty-foot sand (shelly) .....                       | 30         | 1900  |

|   | Thickness.<br>Feet. | Total<br>Feet. |
|---|---------------------|----------------|
| Unrecorded .....  | 115                 | 2015           |
| Gordon sand (gas pocket, 2023'; exhausted after<br>drilling through sand) .....       | 11                  | 2026           |
| Unrecorded .....  | 143                 | 2269           |
| Fifth sand (nice show of gas that did not exhaust) .....                              | 23                  | 2292           |
| Unrecorded .....  | 39                  | 2331           |
| Bayard sand (could smell oil in sand pumpings after<br>washing them thoroughly) ..... | 53                  | 2384           |

The above well starts about 225 feet below the Pittsburgh coal, and was abandoned as a dry hole.

### W. R. Jasper Heirs No. 1 Well Record (687)

Union district, at Colfax. Authority, J. W. McDonald et al. Completed July 23, 1910.

| (Elevation, 926' L.A.T.)                  | Thickness.<br>Feet. | Total<br>Feet. |
|---|---------------------|----------------|
| Conductor .....                           | 16                  | 16             |
| Unrecorded .....                          | 59                  | 75             |
| Freeport coal (Upper) .....               | 5                   | 80             |
| Unrecorded .....                          | 14                  | 94             |
| Sand .....                                | 46                  | 140            |
| Unrecorded .....                          | 80                  | 220            |
| Sand .....                                | 32                  | 252            |
| Kittanning coal (Lower) .....             | 10                  | 262            |
| Unrecorded (water, 360') .....            | 98                  | 360            |
| Sand .....                                | 40                  | 400            |
| Lower Kittanning (Mercer) coal .....      | 6                   | 406            |
| Unrecorded .....                          | 106                 | 512            |
| Slate and lime .....                      | 43                  | 555            |
| Salt sand .....                           | 125                 | 680            |
| Unrecorded .....                          | 70                  | 750            |
| Red rock .....                            | 110                 | 860            |
| Little Lime .....                         | 30                  | 890            |
| Pencil cave .....                         | 10                  | 900            |
| Big Lime .....                            | 80                  | 980            |
| Sand .....                                | 15                  | 995            |
| Red rock .....                            | 5                   | 1000           |
| Big Injun sand, very hard and close ..... | 110                 | 1110           |
| Squaw sand .....                          | 34                  | 1144           |
| Unrecorded .....                          | 200                 | 1344           |
| Slate and lime .....                      | 176                 | 1520           |
| Fifty-foot sand .....                     | 20                  | 1540           |
| Slate and shells .....                    | 20                  | 1560           |
| Thirty-foot sand .....                    | 40                  | 1600           |
| Slate and shells .....                    | 30                  | 1630           |
| Gordon Stray sand .....                   | 15                  | 1645           |
| Red rock and shells .....                 | 55                  | 1700           |
| Gordon sand .....                         | 14                  | 1714           |
| Red rock .....                            | 296                 | 2010           |
| White shale .....                         | 45                  | 2055           |
| Bayard sand .....                         | 2                   | 2057           |

|                                     | Thickness.<br>Feet. | Total.<br>Feet. |
|-------------------------------------|---------------------|-----------------|
| Red rock .....                      | 48                  | 2105            |
| White shale to bottom .....         | 242                 | 2347            |
| 10" casing, 220'; 8¼" casing, 750'. |                     |                 |

The above well starts near the horizon of the Brush Creek coal.

### Edwin Nuzum No. 2504 Well Record (688A)

Union district, 0.8 mile northwest of Hammond. Authority, Hope Natural Gas Company. Completed June 21, 1912.

|  | Thickness.<br>Feet. | Total.<br>Feet. |
|--|---------------------|-----------------|
| Unrecorded .....                                       | 25                  | 25              |
| Sand .....   | 90                  | 115             |
| Unrecorded .....                                       | 37                  | 152             |
| Coal, (Upper Freeport?) .....                          | 3                   | 155             |
| Unrecorded .....                                       | 70                  | 225             |
| Coal, (Lower Freeport?) .....                          | 5                   | 230             |
| Unrecorded .....                                       | 30                  | 260             |
| Sand, ("Gas") (steel line measurement, 275') .....     | 30                  | 290             |
| Unrecorded .....                                       | 60                  | 350             |
| Sand, (II Cow Run) .....                               | 90                  | 440             |
| Unrecorded .....                                       | 10                  | 450             |
| Salt sand .....  | 50                  | 500             |
| Unrecorded .....                                       | 6                   | 506             |
| Sand, salt .....                                       | 84                  | 590             |
| Unrecorded .....                                       | 75                  | 665             |
| Salt sand .....  | 85                  | 750             |
| Unrecorded (water, 775') .....                         | 100                 | 850             |
| Little Lime .....                                      | 10                  | 860             |
| Pencil cave .....                                      | 18                  | 878             |
| Big Lime (steel line measurement, 916') .....          | 114                 | 992             |
| Big Injun sand .....                                   | 113                 | 1105            |
| Unrecorded .....                                       | 4                   | 1109            |
| Squaw sand .....                                       | 23                  | 1132            |
| Unrecorded .....                                       | 152                 | 1284            |
| Sand, (Berea) .....                                    | 16                  | 1300            |
| Unrecorded .....                                       | 220                 | 1520            |
| Fifty-foot sand .....                                  | 70                  | 1590            |
| Unrecorded .....                                       | 253                 | 1843            |
| Gordon sand (steel line measurement, 1849') .....      | 9                   | 1852            |
| Unrecorded .....                                       | 57                  | 1909            |
| Fourth sand .....                                      | 11                  | 1920            |
| Unrecorded .....                                       | 95                  | 2015            |
| Sand, (Fifth) .....                                    | 13                  | 2028            |
| Unrecorded .....                                       | 496                 | 2524            |
| Sand (gas, 2524') (Speechley?) .....                   | 6                   | 2530            |
| Unrecorded to bottom (gas show, 2584') .....           | 396                 | 2926            |
| 10" casing, 279'; 8¼" casing, 923'; 6½" casing, 1861'. |                     |                 |

Pressure test:

Ten-tenths water in 1" opening, equivalent to 37,300 cu. ft. daily.

The above well should start about 500 feet below the horizon of the Pittsburgh coal, according to the Pittsburgh coal—Big Injun sand intervals in the two preceding wells.

**Prospective Oil and Gas Areas, Winfield and Union Districts.**—As mentioned at the beginning of the discussion of these two districts the prospects of opening a pool of either oil or gas therein are not very bright. However, there occurs a pronounced structural terrace along the line between Winfield and Union immediately to the northwest of the axis of the Chestnut Ridge anticline, on which it is barely possible that a pool of these hydro-carbons may rest in the Big Injun and deeper sands. A well southward from Samaria near the road fork on the head of Long run, or another three-fourths mile southward from the mouth of Dunham Lick on Prickett creek would test the matter thoroughly. As mentioned under the account of the oil and gas development in Union, Morgan and Clinton districts, Monongalia, the folding has been so intense along the crest of the Chestnut Ridge arch that the oil and gas may have long ago escaped into the air through the resulting cracks and minor fissures.

### ***Grant District.***

Grant district, Marion, occupies that portion of the county between the West Fork and Tygart Valley rivers, so that most of its area lies along the western slope of the Chestnut Ridge anticline. The Mooresville arch traverses in a north and south direction the western point of the district, where this fold is finally dying out on the steeper western slope of the first mentioned anticline. In this portion of the district several paying gas wells have been drilled. The two following records are from wells therein.

#### **J. Lee Bice No. 1 Well Record (678).**

Grant district, 0.9 mile west of Eldora. Authority, Hog Lick Oil & Gas Company.

| (Elevation, 1020' B.A.T.) | Thickness. Total. |       |
|---------------------------|-------------------|-------|
|                           | Feet.             | Feet. |
| Unrecorded .....          | 440               | 440   |
| Little Dunkard sand ..... | 50                | 490   |
| Unrecorded .....          | 20                | 510   |

|  | Thickness. |             |
|--|------------|-------------|
|  | Feet.      | Total Feet. |
| Big Dunkard sand .....                                 | 37         | 547         |
| Unrecorded .....                                       | 24         | 571         |
| Sand, ("Gas") .....                                    | 48         | 618         |
| Unrecorded .....                                       | 22         | 640         |
| Gas sand .....   | 23         | 663         |
| Unrecorded .....                                       | 145        | 808         |
| First Salt sand .....                                  | 69         | 877         |
| Unrecorded .....                                       | 53         | 930         |
| Second Salt sand .....                                 | 160        | 1090        |
| Unrecorded .....                                       | 256        | 1346        |
| Little Lime .....                                      | 25         | 1371        |
| Unrecorded .....                                       | 40         | 1411        |
| Big Lime .....   | 72         | 1483        |
| Big Injun sand .....                                   | 136        | 1619        |
| Unrecorded .....                                       | 8          | 1627        |
| Squaw sand .....                                       | 24         | 1651        |
| Unrecorded .....                                       | 64         | 1715        |
| Berea Grit .....                                       | 133        | 1848        |
| Unrecorded .....                                       | 159        | 2007        |
| Fifty-foot sand (little show oil and gas, 2010') ..... | 46         | 2053        |
| Unrecorded .....                                       | 47         | 2100        |
| Thirty-foot sand .....                                 | 37         | 2137        |
| Unrecorded .....                                       | 9          | 2146        |
| Gordon Stray sand .....                                | 51         | 2197        |
| Unrecorded .....                                       | 9          | 2206        |
| Gordon sand .....                                      | 14         | 2220        |
| Unrecorded .....                                       | 172        | 2392        |
| Fifth sand .....                                       | 6          | 2398        |
| Unrecorded .....                                       | 131        | 2529        |
| Bayard sand .....                                      | 18         | 2547        |
| Unrecorded to bottom .....                             | 22         | 2569        |

10" casing, 242'; 6% casing, 1420'.

The above well record starts close the horizon of the Pittsburgh coal.

### Harriet Frum No. 1 Well Record (680).

Grant district, 0.6 mile N 20° W of Boothsville. Authority, Grant Development Company.

| (Elevation, 995' B-A.T.)                 | Thickness. |             |
|--|------------|-------------|
|  | Feet.      | Total Feet. |
| Conductor .....                          | 8          | 8           |
| Unrecorded (water, 60' and 35') .....    | 362        | 370         |
| Big Dunkard sand .....                   | 80         | 450         |
| Unrecorded .....                         | 150        | 600         |
| First Gas sand (water) .....             | 40         | 640         |
| Coal, Lower Kittanning .....             | 8          | 648         |
| Unrecorded .....                         | 42         | 690         |
| Second Gas sand (gas, 700') .....        | 50         | 740         |
| Unrecorded .....                         | 40         | 780         |
| Salt sand (water, 800'; gas, 806') ..... | 33         | 813         |
| Unrecorded .....                         | 2          | 815         |
| Second Salt sand .....                   | 115        | 930         |

|  | Thickness. | Total. |
|--|------------|--------|
|  | Feet.      | Feet.  |
| Unrecorded .....                                       | 60         | 990    |
| Red rock.....  | 195        | 1185   |
| Unrecorded .....                                       | 115        | 1300   |
| Big Lime.....  | 67         | 1367   |
| Big Injun sand (gas).....                              | 93         | 1460   |
| Unrecorded .....                                       | 10         | 1470   |
| Big Injun sand, (gas, 1477').....                      | 27         | 1497   |
| Unrecorded .....                                       | 106        | 1603   |
| Squaw sand (oil show, 1604').....                      | 12         | 1615   |
| Unrecorded .....                                       | 258        | 1873   |
| Gantz? sand and unrecorded.....                        | 19         | 1892   |
| Fifty-foot sand (gas show, 1911').....                 | 137        | 2029   |
| Unrecorded .....                                       | 22         | 2051   |
| Gordon Stray sand.....                                 | 10         | 2061   |
| Unrecorded .....                                       | 19         | 2080   |
| Gordon sand.....                                       | 15         | 2095   |
| Unrecorded .....                                       | 73         | 2168   |
| Sand .....   | 10         | 2178   |
| Unrecorded .....                                       | 145        | 2323   |
| Fifth sand and unrecorded.....                         | 64         | 2387   |
| Bayard sand to bottom.....                             | 47         | 2434   |
| 10" casing, 142'; 8¼" casing, 845'; 6½" casing, 1329'. |            |        |

The above well starts about 130 feet below the Pittsburgh coal.

**Prospective Oil and Gas Areas, Grant District.**—The eastern portion of Grant district, Marion county, like Winfield and Union, does not look so promising for either oil or gas in paying quantity for the same reasons as given for the latter districts. However, there are a few small areas that would warrant the drilling of more wells, both from the standpoint of structure and development. (1) That territory for two miles northeaward from the Marion-Taylor county line between the 1300 and 1425-foot contours of Pittsburgh coal as outlined on Map II appears good for Fifty-foot sand gas in view of the good Holt gasser (690) in the edge of Taylor to the southwest; (2) that, west and southwest of Chiefton, for gas in the Big Injun and deeper sands; and (3), that, immediately along the crest of the Mooresville anticline for gas at the same horizons.



| Map No. | NAME OF WELL                   | Location—<br>District | OWNER           | Revised<br>A? |
|---------|--------------------------------|-----------------------|-----------------|---------------|
| 689     | Geo. Tucker No. 1              | Booths Creek          | Colfax          | 1070B         |
| 690     | J. F. Holt No. 1               | Booths Creek          | Dugan et al.    | 980B          |
| 690A    | R. L. Reed No. 1               | Booths Creek          | Hope            |               |
| 691     | R. L. Reed No. 1               | Booths Creek          | South Penn      | 954L          |
| 691A    | Riley-Weathers No. 1           | Booths Creek          |                 |               |
| 692     | G. Wm. Harr No. 1              | Booths Creek          |                 | 980F          |
| 692A    | Geo. Martin No. 1              | Booths Creek          | Steele          | 1030E         |
| 693     | John A. Russell No. 1          | Booths Creek          | Miller et al.   | 1165B         |
| 693A    | Wilson No. 1                   | Booths Creek          |                 |               |
| 694     | Samuel Hibbs No. 1             | Booths Creek          | South Penn      | 1210B         |
| 694A    | James Riley No. 1              | Booths Creek          | Home            |               |
| 695     | Kimball No. 1                  | Booths Creek          |                 | 890F          |
| 696     | John Tolles No. 1              | Booths Creek          | Murphy          | 975L          |
| 697     | Martha Tucker No. 1            | Booths Creek          | P. McGrady      | 1080E         |
| 698     | C. H. Curry No. 1              | Booths Creek          | Hope            | 1150I         |
| 699     | John Williamson No. 1          | Booths Creek          | Taylor          | 1120F         |
| 700     | Harrison Jones Heirs No. 1     | Booths Creek          | Comet O. & G.   | 1205P         |
| 700A    | Harry Swindler No. 1           | Booths Creek          | Comet O. & G.   |               |
| 701     | Harrison Jones Heirs No. 2     | Booths Creek          | Home            | 1272L         |
| 701A    | John T. Whitescarver No. 1     | Booths Creek          | Comet O. & G.   |               |
| 702     | C. E. Dunham No. 1             | Booths Creek          | Phila.          | 1268L         |
| 702A    | Brown Heirs No. 1              | Booths Creek          | Comet O. & G.   |               |
| 703     | Hugh Evans No. 2               | Booths Creek          | Phila.          | 1101L         |
| 704     | Geo. Gawthrop No. 1            | Booths Creek          | Phila.          | 1115B         |
| 704A    | T. A. Gawthrop No. 1           | Booths Creek          | Comet O. & G.   |               |
| 705     | Geo. W. Reynolds No. 1         | Booths Creek          | Phila.          | 1180B         |
| 706     | R. B. Coll No. 1               | Booths Creek          | Phila.          | 1290B         |
| 707     | U. S. Morrow No. 2251          | Booths Creek          | Phila.          | 1270B         |
| 708     | Lizzie E. Morrow No. 2250      | Booths Creek          | Phila.          | 1328L         |
| 708A    | Bartlett No. 1                 | Booths Creek          | Hope            |               |
| 709     | Dan Copeland No. 1             | Flemington            | McGraw          | 1372B         |
| 710     | Martin L. Shields No. 1        | Flemington            | Flemington      | 1215B         |
| 711     | John B. Cather No. 1           | Flemington            | Flemington      | 1140P         |
| 712     | Mrs. H. P. Davidson No. 1      | Flemington            | Mandell         | 1105B         |
| 713     | Pittsvein Coal Co. No. 1       | Flemington            |                 | 1183L         |
| 714     | Hugh Evans No. 1               | Courthouse            | Phila.          | 1136L         |
| 715     | Sarah E. Whitescarver No. 1    | Courthouse            | J. T. McGraw    | 1115B         |
| 715A    | Clare F. Shafer No. 1          | Courthouse            | Home            | 1240B         |
| 716     | Clee Woodford No. 1            | Courthouse            | John Holt       | 980B          |
| 717     | M. Rector coal test            | Courthouse            |                 | 984L          |
| 718     | M. Rector No. 1                | Courthouse            | Rector          | 985L          |
| 719     | A. J. Bartlett coal test       | Courthouse            | Willgus & Grant | 1006L         |
| 720     | Idell Debillier No. 1          | Lyon (Preston)        | Great Elk       | 1190B         |
| 721     | Hamilton Coal Co. coal test.   | Lyon (Preston)        | Hamilton        | 1155B         |
| 722     | Newton Grimes No. 1            | Knottsville           |                 | 1110B         |
| 723     | E. H. Bennett coal test No. 4. | Knottsville           | Mohawk          | 1008L         |
| 724     | E. H. Bennett coal test No. 2. | Knottsville           | Mohawk          | 1022L         |
| 725     | E. E. McDaniel coal test No. 3 | Knottsville           | Mohawk          | 1105B         |
| 726     | Lucinda McDaniel Hrs. No. 1.   | Knottsville           | Hardin          | 998L          |
| 727     | Daniel Sinclair No. 1          | Reno (Preston)        | J. G. Wolf      | 1315H         |
| 728     | Jas. M. Hamilton coal test.    | Reno (Preston)        | J. M. Guffey    | 1314L         |
| 729     | Jas. M. Hamilton coal test.    | Reno (Preston)        | J. Sliney       | 1325L         |
| 730     | Jas. M. Hamilton coal test.    | Cove (Barbour)        | J. M. Guffey    | 1309L         |

Wells in Taylor County.

| PITTSBURGH COAL |           | Big Injun Sand (top) | Thirty Foot Sand (top) | Gordon Sand (top) | Fourth Sand (top) | Fifth Sand (top) | Total Depth | PRODUCING SAND AND REMARKS | Map No. |
|-----------------|-----------|----------------------|------------------------|-------------------|-------------------|------------------|-------------|----------------------------|---------|
| Depth (top)     | Thickness |                      |                        |                   |                   |                  |             |                            |         |
|                 |           | 1132                 |                        |                   |                   |                  | 1667        | B. I. gas                  | 689     |
|                 |           |                      |                        |                   |                   |                  |             | 50-ft. & B. I. gas         | 690     |
|                 |           | 1280                 | 1845                   |                   |                   | 2162             | 2400        | 50-ft. gas                 | 690A    |
|                 |           |                      |                        |                   |                   |                  |             | 50-ft. gas                 | 691     |
|                 |           |                      |                        |                   |                   |                  |             |                            | 691A    |
|                 |           |                      |                        |                   |                   |                  |             | 50-ft. gas show            | 692     |
|                 |           |                      |                        |                   |                   |                  | (1300)      | B. I. gas                  | 692A    |
|                 |           | 1365                 | 1980                   |                   |                   |                  | 2570        | "Gas" and 6th gas show.    | 693     |
|                 |           |                      |                        |                   |                   |                  |             | 50-ft. gas                 | 693A    |
|                 |           |                      |                        |                   |                   |                  |             | 50-ft. oil show            | 694     |
|                 |           | 1195                 |                        |                   |                   | 2088             | 2300        | 5th and 6th gas            | 694A    |
|                 |           |                      |                        |                   |                   |                  | 500?        | 6th gas                    | 695     |
|                 |           | 812                  | 1425                   | 1530              |                   |                  | 2420        | Gas, light show            | 696     |
|                 |           | 925                  |                        |                   |                   |                  | 1955        | B. Lm. gas                 | 697     |
|                 |           |                      |                        |                   |                   |                  | 2200        |                            | 698     |
|                 |           |                      |                        |                   |                   |                  | 2200        |                            | 699     |
|                 |           | 1275                 |                        | 2080              |                   | 2150             | 2500        | B. I. gas                  | 700     |
|                 |           | 1444                 | 1955                   | 2100              |                   | 2307             | 2492        | B. I. gas, light           | 700A    |
|                 |           | 1525                 |                        |                   |                   |                  | 1720        | B. I. gas                  | 701     |
|                 |           |                      |                        |                   |                   |                  |             | B. I. gas                  | 701A    |
|                 |           | 1415                 | 1995                   | 2073              | 2130              | 2319             | 2462        | B. I. gas                  | 702     |
|                 |           | 1235                 |                        | 1886              |                   | 2110             | 2303        |                            | 702A    |
|                 |           | 1225                 |                        | 1900              | 2000              | 2095             | 2124        | 5th gas                    | 703     |
|                 |           | 1220                 |                        |                   |                   | 2066             | 2123        | 5th gas                    | 704     |
|                 |           | 1265                 |                        |                   |                   | 2097             | 2145        | 5th gas                    | 704A    |
|                 |           | 1295                 |                        | 1946              |                   | 2145             | 2650        | 5th gas                    | 705     |
|                 |           | 1315                 |                        |                   |                   | 2190             | 2234        | 5th gas                    | 706     |
|                 |           | 1275                 |                        |                   |                   | 2170             | 2250        | 50-ft. gas                 | 707     |
|                 |           | 1260                 |                        |                   |                   |                  | 1733        | 50-ft. gas                 | 708     |
|                 |           | 1285                 |                        |                   |                   |                  |             | B. I. gas                  | 708A    |
|                 |           | 1445                 |                        |                   |                   | 2300             | 2549        | B. I. gas                  | 709     |
|                 |           |                      |                        |                   |                   |                  |             | Dry hole                   | 710     |
|                 |           | 1260                 |                        |                   |                   | 2122             | 2239        | 50-ft. gas                 | 711     |
|                 |           | 1360                 |                        |                   |                   |                  | 2128        | B. I. & 5th gas, light.    | 712     |
|                 |           | 1575                 | 2140                   | 2224              |                   |                  | 3019½       | B. I. gas show             | 713     |
|                 |           | 1333                 |                        |                   | 2116              | 2206             | 2680        | 5th gas                    | 714     |
|                 |           |                      |                        |                   |                   |                  | (2476)      | B. I. & 5th gas show.      | 715     |
|                 |           | 1572                 | 2175                   | 2128              |                   | 2435             | 2597        | Dry hole                   | 715A    |
|                 |           |                      |                        |                   |                   |                  |             | Gas show                   | 716     |
|                 |           |                      |                        |                   |                   |                  |             | Coal test                  | 717     |
|                 |           | (600)                |                        |                   |                   |                  | 2515        | B. I. oil show             | 718     |
|                 |           |                      |                        |                   |                   |                  | 456         | Coal test                  | 719     |
|                 |           |                      |                        |                   |                   |                  |             | Salt oil & gas show        | 720     |
|                 |           |                      |                        |                   |                   |                  | 225         | Coal test                  | 721     |
|                 |           |                      |                        |                   |                   |                  |             | Dry hole                   | 722     |
|                 |           |                      |                        |                   |                   |                  |             | Coal test                  | 723     |
|                 |           |                      |                        |                   |                   |                  | 140         | Coal test                  | 724     |
|                 |           |                      |                        |                   |                   |                  | 144         | Coal test                  | 725     |
|                 |           | 970                  | 1370                   |                   |                   |                  | 2502        | Dry hole                   | 726     |
|                 |           |                      |                        |                   |                   |                  |             | Dry hole                   | 727     |
|                 |           |                      |                        |                   |                   |                  |             | Coal test                  | 728     |
|                 |           |                      |                        |                   |                   |                  |             | Coal test                  | 729     |
|                 |           |                      |                        |                   |                   |                  |             | Coal test                  | 730     |

The accompanying table contains the abbreviated logs of 31 wells in Taylor county as well as levels on most of the same, along with elevations and data on other wells the records of which could not be obtained. The borings are numbered from 689 to 730 inclusive and grouped as in Monongalia and Marion by magisterial districts, the serial number in each instance corresponding to the number of the same well on Map II. For further particulars the reader is referred to the explanations directly following the Monongalia table of well records. Under the column headed "Owner" the following abbreviations are used:

|                    |                                |
|--------------------|--------------------------------|
| Colfax O. & G..... | Colfax Oil & Gas Company.      |
| Comet O. & G.....  | Comet Oil & Gas Company.       |
| Flemington .....   | Flemington Oil & Gas Company.  |
| Great Elk.....     | Great Elk Oil & Gas Company.   |
| Hamilton .....     | Hamilton Coal Company.         |
| Hardin .....       | George and Andrew Hardin.      |
| Home .....         | Home Drilling Company.         |
| Hope .....         | Hope Natural Gas Company.      |
| Mandell .....      | Mandell Oil & Gas Company.     |
| Mohawk .....       | Mohawk Smokeless Coal Company. |
| Philadelphia ..... | Philadelphia Company.          |
| South Penn.....    | South Penn Oil Company.        |
| Taylor .....       | Taylor County Company.         |

For explanations of column headings in the accompanying list for Taylor, the reader is referred to the same immediately following the tables for Monongalia and Marion counties.

For the reasons given on the pages immediately following the Monongalia table of well records the complete logs of a number of borings in Taylor county along with a discussion of the structure and development will now be given. As heretofore, the serial number is published, not only in the foregoing table, but along with the heading in parenthesis when the complete log is given, as well as on Map II.

**Booths Creek District.**

Booths Creek district occupies the northwest portion of Taylor county, and its area is almost bisected in a northeast-southwest direction by the axis of the great Chestnut Ridge anticline. On entering Taylor from Marion county this fold flattens down to the southwest, having lost much of its prominence of eastern Monongalia. No paying oil wells have yet been discovered in the county, but in this district there occur several paying gas wells along the crest and a short distance down the slopes of the last mentioned arch in the rocks. The principal producing sands therein are the Big Injun, Fifty-foot and Fifth. The development will now be discussed from north to south across the district.

In the northwest corner of the district one-half dozen wells have been drilled, only one of which—**J. F. Holt No. 1 (690)**—has proved a good gasser. This well was completed soon after the opening of the Shinnston oil pool of eastern Harrison county, and it has an initial volume of 13 million cubic feet daily, with a rock pressure of 220 pounds to the square inch. When first shut in this well would give its rock pressure in less than one minute. A light flow of gas was struck in the Big Injun sand.

The detailed log of the **R. L. Reed No. 1 well (691)**, located 0.2 mile southwest of Boothsville, is published on pages 338-339 of Vol. I(A) of the State Survey reports. This well starts near the crop of the Elk Lick limestone, about 250 feet below the Pittsburgh coal horizon; hence, the coal at 435 feet represents the Upper Kittanning instead of the Upper Freeport as given on the pages mentioned. A light show of gas was encountered in the Fifty-foot.

The following is the record of practically a dry hole located 0.9 mile southwest of the Holt well (690):

**John A. Russell No. 1 Well Record (693).**

Booths Creek district, 1 mile south of Boothsville. Authority Geo. E. Miller & Company. Completed Dec. 28, 1910.

| (Elevation, 1165' B-A. T.) | Thickness. Total. |       |
|----------------------------|-------------------|-------|
|                            | Feet.             | Feet. |
| Conductor .....            | 32                | 32    |
| Unrecorded .....           | 418               | 450   |

|  | Thickness. | Total. |
|--|------------|--------|
|  | Feet.      | Feet.  |
| Burning Springs sand.....                      | 20         | 470    |
| Unrecorded .....                               | 70         | 540    |
| Coal, (Upper Kittanning).....                  | 3          | 543    |
| Unrecorded .....                               | 2          | 545    |
| Gas sand (gas, 545').....                      | 25         | 570    |
| Unrecorded .....                               | 720        | 1290   |
| Big Lime.....                                  | 75         | 1365   |
| Big Injun sand.....                            | 110        | 1475   |
| Unrecorded .....                               | 940        | 2415   |
| Sand, (Fifth).....                             | 30         | 2445   |
| Slate .....                                    | 20         | 2465   |
| Sand, (Bayard) (light show of gas, 2475')..... | 10         | 2475   |
| Slate and shale to bottom.....                 | 95         | 2570   |

The following is the record of a well in the northeast corner of Booths Creek district, in which sufficient gas was encountered in the Big Lime to furnish domestic fuel for three families. The well mouth is about 275 feet below the horizon of the Pittsburgh coal:

#### Martha Tucker No. 1 Well Record (697).

Booth's Creek district, 1 mile south 10° west of Valley Falls.  
Authority, P. H. McGrady.

|   | Thickness. | Total. |
|---|------------|--------|
| (Elevation, 1080' B-A. T.)                | Feet.      | Feet.  |
| Conductor .....                           | 8          | 8      |
| Unrecorded .....                          | 8          | 16     |
| Coal, (Upper Kittanning).....             | 4          | 20     |
| Unrecorded (water, 40').....              | 190        | 210    |
| Coal, (Tonesta) .....                     | 9          | 219    |
| Unrecorded .....                          | 16         | 235    |
| Coal, (Upper Mercer).....                 | 7          | 242    |
| Unrecorded .....                          | 3          | 245    |
| Sand and unrecorded.....                  | 70         | 315    |
| Slate and unrecorded.....                 | 45         | 360    |
| Gas sand.....                             | 30         | 390    |
| Unrecorded .....                          | 160        | 550    |
| Salt sand (gas, 805') and unrecorded..... | 272        | 812    |
| Sand and lime (Big Injun sand).....       | 128        | 940    |
| Unrecorded .....                          | 380        | 1320   |
| Sand and slate.....                       | 25         | 1345   |
| Fifty-foot sand.....                      | 50         | 1395   |
| Unrecorded .....                          | 30         | 1425   |
| Thirty-foot sand.....                     | 15         | 1440   |
| Unrecorded .....                          | 70         | 1510   |
| Gordon Stray sand.....                    | 70         | 1580   |
| Unrecorded .....                          | 50         | 1630   |
| Gordon sand.....                          | 5          | 1635   |
| Unrecorded to bottom.....                 | 785        | 2420   |

10" casing, 150'; 8" casing, 740'.

Along the southeast border of Booths Creek district a very prolific gas pool was opened a few years ago by Hon John T. McGraw of Grafton. The Big Injun, Fifty-foot and Fifth are the main producing sands. The eleven following records from wells in this field, most of which were furnished the Survey by Patrick McGrady of Grafton, give valuable data as to the thickness and depth of probable minable coals, and the volume and rock pressure of the gas encountered:

### Harrison Jones Heirs No. 1 Well Record (700).

Booth's Creek district, 1.1 miles northwest of Pruntytown. Authority, Comet Oil & Gas Company.

| (Elevation, 1205' B-A. T.)    | Thickness. Total. |       |
|-------------------------------|-------------------|-------|
|                               | Feet.             | Feet. |
| Conductor .....               | 16                | 16    |
| Unrecorded .....              | 4                 | 20    |
| Hard sand (water, 30').....   | 30                | 50    |
| Unrecorded .....              | 90                | 140   |
| Sand (water, 155').....       | 20                | 160   |
| Unrecorded .....              | 125               | 285   |
| Coal, (Upper Freeport).....   | 3                 | 288   |
| Unrecorded .....              | 52                | 340   |
| Sand, ("Gas").....            | 45                | 385   |
| Coal, (Upper Kittanning)..... | 7                 | 392   |
| Unrecorded .....              | 63                | 455   |
| Coal, (Lower Kittanning)..... | 5                 | 460   |
| Unrecorded .....              | 70                | 530   |
| Coal, (Upper Mercer).....     | 9                 | 539   |
| Unrecorded .....              | 16                | 555   |
| Coal, (Lower Mercer).....     | 8                 | 563   |
| Unrecorded .....              | 12                | 575   |
| Sand .....                    | 25                | 600   |
| Unrecorded .....              | 80                | 680   |
| Salt sand.....                | 35                | 715   |
| Unrecorded .....              | 12                | 727   |
| Salt sand.....                | 163               | 890   |
| Unrecorded .....              | 60                | 950   |
| Sand .....                    | 100               | 1050  |
| Little Lime.....              | 100               | 1150  |
| Unrecorded .....              | 60                | 1210  |
| Big Lime.....                 | 65                | 1275  |
| Big Injun sand (gas).....     | 75                | 1350  |
| Unrecorded .....              | 50                | 1400  |
| Squaw sand.....               | 135               | 1535  |
| Unrecorded .....              | 87                | 1622  |
| Berea Grit.....               | 38                | 1660  |
| Unrecorded .....              | 75                | 1735  |
| Fifty-foot sand.....          | 20                | 1755  |
| Unrecorded .....              | 165               | 1920  |
| Gordon Stray sand.....        | 8                 | 1928  |
| Unrecorded .....              | 152               | 2080  |

|                                      | Thickness.<br>Feet. | Total<br>Feet. |
|--------------------------------------|---------------------|----------------|
| Sand, (Fourth).....                  | 9                   | 2089           |
| Unrecorded .....                     | 61                  | 2150           |
| Fifth sand .....                     | 35                  | 2185           |
| Unrecorded .....                     | 33                  | 2218           |
| Bayard sand .....                    | 20                  | 2238           |
| Unrecorded to bottom.....            | 262                 | 2500           |
| 10" casing, 165'; 6½" casing, 1242'. |                     |                |
| Dry hole.                            |                     |                |

The above well starts about 275 feet below the Pittsburgh coal horizon.

### Henry Swindler No. 1 Well Record (700A).

Booths Creek district, 1.1 miles northwest of Pruntytown. Authority, Comet Oil & Gas Company.

|  | Thickness.<br>Feet. | Total<br>Feet. |
|--|---------------------|----------------|
| Unrecorded (water, 30').....                             | 140                 | 140            |
| Sand .....   | 20                  | 160            |
| Unrecorded .....   | 290                 | 450            |
| Coal, (Upper Freeport).....                              | 10                  | 460            |
| Unrecorded .....   | 45                  | 505            |
| Sand .....   | 15                  | 520            |
| Unrecorded .....   | 68                  | 588            |
| Coal, (Upper Kittanning).....                            | 6                   | 594            |
| Unrecorded .....   | 88                  | 682            |
| Coal, (Lower Kittanning).....                            | 12                  | 694            |
| Unrecorded .....   | 32                  | 726            |
| Sand (water, 810').....                                  | 99                  | 825            |
| Coal, (Upper Mercer).....                                | 9                   | 834            |
| Unrecorded .....   | 526                 | 1360           |
| Big Lime .....   | 84                  | 1444           |
| Big Injun sand (gas, 1454').....                         | 86                  | 1530           |
| Unrecorded .....   | 245                 | 1775           |
| Berea Grit.....  | 15                  | 1790           |
| Unrecorded .....   | 110                 | 1900           |
| Fifty-foot sand.....                                     | 40                  | 1940           |
| Unrecorded .....   | 15                  | 1955           |
| Thirty-foot sand.....                                    | 20                  | 1975           |
| Unrecorded .....   | 125                 | 2100           |
| Gordon sand .....  | 5                   | 2105           |
| Unrecorded .....   | 202                 | 2307           |
| Fifth sand .....   | 48                  | 2355           |
| Unrecorded (Bayard sand broken up) to bottom.....        | 137                 | 2492           |
| 10" casing, 150'; 6" casing, 1457'.                      |                     |                |
| "25000 to 30000 cu. ft. of gas dally show in Big Injun." |                     |                |

The above well record starts about 100 feet below the Pittsburgh coal.

**Harrison Jones Heirs No. 2 Well Record (701).**

Booths Creek district, 0.5 mile northwest of Pruntytown. Authority, Home Oil & Gas Company.

|   | Thickness. | Total. |
|---|------------|--------|
| (Elevation, 1272' L-A. T.)              | Feet.      | Feet.  |
| Unrecorded .....                        | 530        | 530    |
| Coal, (Upper Freeport).....             | 5          | 535    |
| Unrecorded .....                        | 105        | 640    |
| Coal, Upper Kittanning).....            | 5          | 645    |
| Unrecorded .....                        | 825        | 1470   |
| Big Lime .....                          | 55         | 1525   |
| Big Injun sand (little gas, 1533')..... | 115        | 1640   |
| Unrecorded to bottom.....               | 80         | 1720   |
| "Abandoned as dry hole."                |            |        |

The above well starts 54 feet by hand-level below the Pittsburgh coal, according to Reger.

The **Harrison Jones No. 2 Well (701A)**, located 0.5 mile westward from Pruntytown, had an initial gas production of 3/4 million cubic feet from the Big Injun, with a rock pressure of 450 pounds per square inch.

**C. E. Dunham No. 1 Well Record (702).**

Booths Creek district, 1.5 miles west of Pruntytown. Authority, Philadelphia Company.

|                                   | Thickness. | Total. |
|-----------------------------------|------------|--------|
| (Elevation, 1268' L-A. T.)        | Feet.      | Feet.  |
| Soil, slate, lime, sand, etc..... | 87         | 87     |
| Lime (water, 90').....            | 15         | 102    |
| Red rock .....                    | 20         | 122    |
| Slate .....                       | 30         | 152    |
| Lime (water, 180').....           | 38         | 190    |
| Shale .....                       | 13         | 203    |
| Coal, (Bakerstown) .....          | 4          | 207    |
| Shale .....                       | 10         | 217    |
| Slate .....                       | 25         | 242    |
| Red rock .....                    | 12         | 254    |
| Lime and slate.....               | 30         | 284    |
| Lime .....                        | 7          | 291    |
| Slate .....                       | 25         | 316    |
| Red rock .....                    | 10         | 326    |
| Lime .....                        | 14         | 340    |
| Red rock .....                    | 8          | 348    |
| Lime and slate.....               | 61         | 409    |
| Shale .....                       | 20         | 429    |
| Slate and lime.....               | 47         | 476    |
| Sand ("Gas").....                 | 39         | 515    |
| Slate and lime.....               | 90         | 605    |
| Coal, (Lower Kittanning).....     | 2          | 607    |
| Lime and slate.....               | 31         | 638    |
| Coal, (Clarion) .....             | 7          | 645    |



|  | Thickness.<br>Feet. | Total.<br>Feet. |
|--|---------------------|-----------------|
| Lime .....   | 15                  | 660             |
| Shale and some coal (Brookville).....                                      | 18                  | 678             |
| Slate and lime.....  | 64                  | 742             |
| Slate and shells.....  | 28                  | 770             |
| Sand .....   | 15                  | 785             |
| Coal, (Upper Mercer).....  | 2                   | 787             |
| Sand, salt.....  | 35                  | 822             |
| Slate and unrecorded.....  | 510                 | 1332            |
| Big Lime (hard).....   | 83                  | 1415            |
| Big Injun sand.....  | 88                  | 1503            |
| Slate and lime.....  | 25                  | 1528            |
| Slate and shells.....  | 127                 | 1755            |
| Lime and slate.....  | 65                  | 1820            |
| Sand .....   | 10                  | 1830            |
| Slate .....  | 42                  | 1872            |
| Fifty-foot sand .....  | 90                  | 1962            |
| Slate .....  | 33                  | 1995            |
| Thirty-foot sand .....   | 20                  | 2015            |
| Slate and lime shells.....   | 40                  | 2055            |
| Gordon Stray sand.....   | 12                  | 2067            |
| Slate .....  | 6                   | 2073            |
| Gordon sand .....  | 5                   | 2078            |
| Red rock .....   | 15                  | 2093            |
| Lime .....   | 8                   | 2101            |
| Red rock .....   | 29                  | 2130            |
| Fourth sand (limy).....  | 40                  | 2170            |
| Red rock .....   | 45                  | 2215            |
| Sand .....   | 9                   | 2224            |
| Red rock .....   | 43                  | 2267            |
| Sand .....   | 5                   | 2272            |
| Red rock.....  | 6                   | 2278            |
| Sand, brown .....  | 4                   | 2282            |
| Red rock and shells.....   | 37                  | 2319            |
| Fifth sand, brown (gas, 2324').....  | 15                  | 2334            |
| Red rock .....   | 44                  | 2378            |
| Bayard sand .....  | 15                  | 2393            |
| Slate .....  | 12                  | 2405            |
| Lime .....   | 45                  | 2450            |
| Red rock .....   | 12                  | 2462            |
| 10" casing, 285'; 8" casing, 944'; 6½" casing, 1346'; 3" tubing.<br>1892'. |                     |                 |

The above well starts about 200 feet below the Pittsburgh coal horizon. It had an initial gas production from the Fifth sand of 750,000 cubic feet daily natural, but after being shot made 1,500,000 cu. ft. daily, with a rock pressure of about 675 lbs., according to Patrick McGrady.

**Brown Heirs No. 1 Well Record (702A).**

Booths Creek district, 1.6 miles west of Pruntytown. Authority,  
Comet Oil & Gas Company.

|   | Thickness. Total. |       |
|---|-------------------|-------|
|   | Feet.             | Feet. |
| Unrecorded (water, 165').....                         | 270               | 270   |
| Little Dunkard? sand (Big Dunkard).....               | 40                | 310   |
| Unrecorded .....                                      | 90                | 400   |
| Sand, ("Gas") .....                                   | 40                | 440   |
| Unrecorded .....                                      | 28                | 468   |
| Coal, (Lower Kittanning).....                         | 8                 | 476   |
| Unrecorded .....                                      | 32                | 508   |
| Coal, (Clarion) .....                                 | 4                 | 512   |
| Unrecorded .....                                      | 33                | 545   |
| Coal, (Brookville) .....                              | 7                 | 552   |
| Unrecorded .....                                      | 23                | 575   |
| Sand .....  | 5                 | 580   |
| Unrecorded .....                                      | 5                 | 585   |
| Coal, (Upper Mercer).....                             | 3                 | 588   |
| Unrecorded .....                                      | 7                 | 595   |
| Sand .....  | 12                | 607   |
| Coal, (Lower Mercer).....                             | 6                 | 613   |
| Sand .....  | 55                | 668   |
| Unrecorded .....                                      | 487               | 1155  |
| Big Lime .....  | 80                | 1235  |
| Big Injun sand.....                                   | 132               | 1367  |
| Unrecorded .....                                      | 743               | 2110  |
| Fifth sand (little gas, 2130').....                   | 35                | 2145  |
| Unrecorded .....                                      | 65                | 2210  |
| Bayard sand .....                                     | 40                | 2250  |
| Unrecorded to bottom.....                             | 53                | 2303  |
| 10" casing, 190'; 8" casing, 661'; 6½" casing, 1260'. |                   |       |
| Dry hole. Starts about 315' below Pittsburgh coal.    |                   |       |

**Hugh Evans No. 2 Well Record (703)**

Booths Creek district, 2 miles S 75° W of Pruntytown. Authority,  
Philadelphia Company.

| (Elevation, 1101' L-A. T.)             | Thickness. Total. |       |
|--|-------------------|-------|
|  | Feet.             | Feet. |
| Conductor .....                        | 16                | • 16  |
| Unrecorded (water, 17', 150').....     | 199               | 215   |
| Coal, (Upper Freeport).....            | 3                 | 218   |
| Unrecorded .....                       | 3                 | 221   |
| Little Dunkard sand (water, 227')..... | 40                | 261   |
| Unrecorded .....                       | 39                | 300   |
| Big Dunkard sand.....                  | 40                | 340   |
| Coal, (Upper Kittanning).....          | 5                 | 345   |
| Unrecorded .....                       | 130               | 475   |
| Coal, (Upper Mercer).....              | 6                 | 481   |
| Unrecorded .....                       | 28                | 509   |
| Sand, (Salt) .....                     | 56                | 565   |
| Unrecorded .....                       | 65                | 630   |
| Salt sand (water, 635').....           | 25                | 655   |
| Unrecorded .....                       | 495               | 1150  |

|  | Thickness.<br>Feet. | Total<br>Feet. |
|--|---------------------|----------------|
| Big Lime .....   | 75                  | 1225           |
| Big Injun sand .....   | 115                 | 1340           |
| Unrecorded .....   | 55                  | 1395           |
| Squaw sand .....   | 85                  | 1480           |
| Unrecorded .....   | 615                 | 2095           |
| Fifth sand (gas, 2100') to bottom.....   | 29                  | 2124           |
| 10" casing, 261'; 8" casing, 412'; 6½" casing, 1180'.  |                     |                |
| "Rock pressure, 680 lbs. in Fifth sand; initial volume, 1,500,000 cu. ft., natural; 3,000,000 cu. ft. after being shot." |                     |                |

The above well starts about 350 feet below the Pittsburgh coal horizon.

### Geo. Gawthrop No. 1 Well Record (704)

Booths Creek district, 2.3 miles S 75° W of Pruntytown. Authority, Philadelphia Company.

|  | Thickness.<br>Feet. | Total<br>Feet. |
|--|---------------------|----------------|
| (Elevation, 1115' B-A. T.)   |                     |                |
| Unrecorded .....   | 1220                | 1220           |
| Big Injun sand.....  | 125                 | 1345           |
| Unrecorded .....   | 330                 | 1675           |
| Fifty-foot sand.....   | 75                  | 1750           |
| Unrecorded .....   | 316                 | 2066           |
| Fifth sand (gas, 2074' and 2106') to bottom.....   | 57                  | 2123           |
| "Initial volume from Fifth sand, ¾ million cu. ft. natural and 1½ million after being shot." |                     |                |

### T. A. Gawthrop No. 1 Well Record (704A).

Booths Creek district, 2 miles southwest of Pruntytown. Authority, Comet Oil and Gas Company. Completed in May, 1913.

|                                       | Thickness.<br>Feet. | Total<br>Feet. |
|---------------------------------------|---------------------|----------------|
| Conductor .....                       | 25                  | 25             |
| Unrecorded (Water, 25' and 165')..... | 260                 | 285            |
| Sand, Little Dunkard.....             | 21                  | 306            |
| Unrecorded .....                      | 18                  | 324            |
| Coal, (Upper Freeport).....           | 4                   | 328            |
| Unrecorded .....                      | 142                 | 470            |
| Coal (Lower Kittanning).....          | 4                   | 474            |
| Unrecorded .....                      | 26                  | 500            |
| Coal (Clarion) (water).....           | 6                   | 506            |
| Unrecorded .....                      | 4                   | 510            |
| Sand .....                            | 25                  | 535            |
| Unrecorded .....                      | 45                  | 580            |
| Coal (Upper Mercer).....              | 6                   | 586            |
| Unrecorded .....                      | 49                  | 635            |
| Sand (Salt) (water, 690').....        | 129                 | 864            |
| Unrecorded .....                      | 306                 | 1170           |
| Big Lime .....                        | 95                  | 1265           |
| Big Injun sand.....                   | 115                 | 1380           |

|  | Thickness. | Total |
|--|------------|-------|
|  | Feet.      | Feet. |
| Unrecorded .....                             | 315        | 1695  |
| Sand, Fifty-foot .....                       | 70         | 1765  |
| Unrecorded .....                             | 332        | 2097  |
| Sand, Fifth (Gas, 2098', 2107', 2110') ..... | 46         | 2143  |
| Unrecorded to bottom .....                   | 2          | 2145  |

This well made about 1,500,000 cu. ft. of gas daily, with a rock pressure of 700 pounds.

### Geo. W. Reynolds No. 1 Well Record (705).

Booths Creek district, 2 miles west of Meadland. Authority, Philadelphia Company.

| (Elevation, 1180' B-A. T.)   | Thickness. | Total |
|--|------------|-------|
|  | Feet.      | Feet. |
| Unrecorded .....   | 528        | 528   |
| Coal, (Lower Kittanning) .....   | 10         | 538   |
| Unrecorded .....   | 22         | 560   |
| Coal, (Clarion) .....  | 10         | 570   |
| Unrecorded .....   | 2          | 572   |
| Sand, (II Cow Run) .....   | 58         | 630   |
| Unrecorded .....   | 23         | 653   |
| Coal, (Upper Mercer) .....   | 10         | 663   |
| Unrecorded .....   | 32         | 695   |
| Salt sand (water, 725') .....  | 235        | 930   |
| Unrecorded .....   | 280        | 1210  |
| Big Lime .....   | 85         | 1295  |
| Big Injun sand .....   | 95         | 1390  |
| Unrecorded .....   | 70         | 1460  |
| Squaw sand .....   | 90         | 1555  |
| Unrecorded .....   | 595        | 2145  |
| Fifth sand (gas, 2150') .....  | 45         | 2190  |
| Unrecorded .....   | 30         | 2220  |
| Sand .....   | 45         | 2265  |
| Unrecorded .....   | 15         | 2280  |
| Bayard sand .....  | 95         | 2375  |
| Unrecorded to bottom .....   | 275        | 2650  |
| 10" casing, 190'; 8" casing, 930'; 6" casing, 1460'.                     |            |       |
| "400,000 cu. ft. natural, and 800,000 cu. ft. after shot in Fifth sand." |            |       |

The above well record starts about 270 feet below the Pittsburgh coal.

### R. B. Gall No. 1 Well Record (706).

Booths Creek district, 1.1 miles S 80° E of Meadland. Authority, Philadelphia Company.

| (Elevation, 1290' B-A. T.) | Thickness. | Total |
|----------------------------|------------|-------|
|                            | Feet.      | Feet. |
| Unrecorded .....           | 1315       | 1315  |
| Big Injun sand .....       | 85         | 1400  |

|                              | Thickness. | Total. |
|------------------------------|------------|--------|
|                              | Feet.      | Feet.  |
| Unrecorded .....             | 368        | 1768   |
| Fifty-foot sand .....        | 107        | 1875   |
| Unrecorded .....             | 315        | 2190   |
| Fifth sand (gas, 2200) ..... | 35         | 2225   |
| Unrecorded to bottom .....   | 9          | 2234   |

" $\frac{1}{4}$  million cu. ft. daily natural, and  $\frac{1}{2}$  million after shot, but later fell back to  $\frac{1}{4}$  million daily from Fifth sand."

#### U. S. Morrow No. 2251 Well Record (707).

Booths Creek district, 1 mile east of Meadland. Authority, Philadelphia Company.

|   | Thickness. | Total. |
|---|------------|--------|
| (Elevation, 1270' B-A. T.)                                  | Feet.      | Feet.  |
| Unrecorded .....  | 1260       | 1260   |
| Big Injun sand and unrecorded .....                         | 455        | 1715   |
| Fifty-foot sand (gas, 1720') and unrecorded to bottom ..... | 18         | 1733   |

"Initial gas volume from Fifty-foot sand, 3,000,000 cu. ft. daily."

#### Lizzie E. Morrow No. 2250 Well Record (708).

Booths Creek district, 0.7 mile east of Meadland. Authority, Philadelphia Company.

|                                | Thickness. | Total. |
|--------------------------------|------------|--------|
| (Elevation, 1328' L-A. T.)     | Feet.      | Feet.  |
| Conductor .....                | 8          | 8      |
| Unrecorded .....               | 47         | 55     |
| Coal, (Harlem) .....           | 4          | 59     |
| Unrecorded (water, 240') ..... | 126        | 285    |
| Little Dunkard sand .....      | 35         | 320    |
| Unrecorded .....               | 36         | 356    |
| Sand .....                     | 24         | 380    |
| Unrecorded .....               | 54         | 434    |
| Big Dunkard sand .....         | 46         | 480    |
| Coal, (Upper Kittanning) ..... | 3          | 483    |
| Unrecorded .....               | 712        | 1195   |
| Big Lime .....                 | 80         | 1275   |
| Big Injun sand .....           | 84         | 1359   |
| Unrecorded .....               | 372        | 1731   |
| Fifty-foot sand (gas) .....    | 56         | 1787   |
| Unrecorded .....               | 383        | 2170   |
| Fifth sand .....               | 50         | 2220   |
| Unrecorded to bottom .....     | 30         | 2250   |

10" casing, 185'; 3" tubing, 1358'.  
 "Initial volume, 250,000 cu. ft., with rock pressure of 480 lbs."

The above well starts on top of the Grafton sandstone or about 275 feet below the Pittsburgh coal horizon.

The Bartlett No. 1 well (708A), located 0.5 mile west of Patton Knob and completed during 1912, is reported as having an initial volume of 1,000,000 cu. ft. of gas daily from the Big Injun, with a rock pressure of 600 lbs. to the sq. inch.

On the crest of the Chestnut Ridge anticline,  $\frac{3}{4}$  mile southwest of McGee, two practically dry holes were drilled on the **C. H. Curry (698)** and **John Williamson (699)** farms to a depth of 2300 and 2200 feet respectively. The wells start over 600 feet below the horizon of the Pittsburgh coal; hence, both penetrated the Bayard sand and probably the horizon of the Elizabeth. A light flow of gas is reported from the Williamson boring.

In January, 1913, the Home Drilling Company of Grafton struck a good gasser in the Bayard sand on the James Riley farm (694A), 0.2 mile northwest of Hepzibah, which, according to O. C. Jefferys, interested in the company, on open flow, gaged 40-tenths inches of mercury from a 2-inch opening, being equivalent to 1,050,000 cubic feet daily. Its rock pressure was 960 pounds to the square inch. The record is as follows:

### James Riley No. 1 Well Record (694A).

Booths Creek district, 0.2 mile northwest of Hepzibah. Authority, Home Drilling Co.

|   | Thickness.<br>Feet. | Total.<br>Feet. |
|---|---------------------|-----------------|
| Conductor .....                         | 6                   | 6               |
| Unrecorded .....                        | 129                 | 135             |
| Little Dunkard sand (water, 140') ..... | 105                 | 240             |
| Unrecorded .....                        | 15                  | 255             |
| Big Dunkard sand .....                  | 115                 | 370             |
| Coal (Upper Freeport) (water) .....     | 8                   | 378             |
| Unrecorded .....                        | 37                  | 415             |
| Sand (water) .....                      | 40                  | 455             |
| Unrecorded .....                        | 15                  | 470             |
| Coal (Upper Kittanning) (water) .....   | 8                   | 478             |
| Unrecorded .....                        | 7                   | 458             |
| Gas sand .....                          | 35                  | 520             |
| Unrecorded .....                        | 45                  | 565             |
| Salt sand (II Cow Run) .....            | 115                 | 680             |
| Coal (Tonesta) .....                    | 6                   | 686             |
| Unrecorded .....                        | 234                 | 920             |
| Sand (Maxton) .....                     | 45                  | 965             |
| Unrecorded .....                        | 135                 | 1100            |
| Big Lime .....                          | 95                  | 1195            |
| Big Injun sand .....                    | 75                  | 1270            |
| Unrecorded .....                        | 20                  | 1290            |
| Squaw sand .....                        | 10                  | 1300            |
| Unrecorded .....                        | 310                 | 1610            |
| Fifty-foot sand (broken) .....          | 270                 | 1880            |
| Unrecorded .....                        | 208                 | 2088            |

|  | Thickness.<br>Feet. | Total.<br>Feet. |
|--|---------------------|-----------------|
| Fifth sand (little gas).....                 | 32                  | 2120            |
| Unrecorded .....                             | 62                  | 2182            |
| Bayard sand (gas).....                       | 50                  | 2232            |
| Unrecorded to bottom.....                    | 68                  | 2300            |
| 8 inch casing, 832'; rock pressure 1000 lbs. |                     |                 |

During February of this year, the **Wilson No. 1 well (693A)**, 1.6 miles due west, near the Taylor-Harrison line, came in a heavy gasser in the Fifty-foot. Its initial volume is reported at 3,000,000 cubic feet daily.

One-half mile southeastward, the **George Martin No. 1 well (692A)** was drilled about 30 years ago down to the top of the Big Injun, where a flow of gas was encountered and the tools lost. The well was not drilled any deeper and the gas from same was never utilized.

#### **Prospective Oil and Gas Areas, Booths Creek District.—**

In the writer's judgment no paying oil will ever be opened in this district, owing to the high comparative structural level its area occupies. The last mentioned feature is very much in its favor when gas is considered, and there yet remains a large untested acreage therein that warrants further drilling. (1) That territory on the western slope of the Chestnut Ridge anticline lying between the 1350 and 1500-foot contour of Pittsburgh coal, as outlined on Map II, appears favorable for gas in the Fifty-foot sand; (2) that, lying south of an east and west line through Hepzibah and west of a meridian line through McGee, for gas in one or more of four sands; viz., Big Injun, Fifty-foot, Fifth and Bayard; and (3) that, north-westward from McGee to the dividing ridge on the north side of Turkey run would justify a test through the Fifth and Bayard sands.

#### ***Flemington District.***

Flemington district occupies the southwest corner of Taylor county, and its entire area lies in the Ligonier synclinal basin. Only a small portion lies on the east side of the axis of the latter fold. Five wells have been drilled for oil and gas within its boundaries, in three of which light gas flows were

encountered. The following records from wells therein give much data of interest:

### Dan Copeland No. 1 Well Record (709).

Flemington district, 1.1 miles S E of Meadland. Authority, John T. McGraw. Completed about 1906.

| (Elevation, 1372' B-A. T.)    | Thickness. Total. |       |
|-------------------------------|-------------------|-------|
|                               | Feet.             | Feet. |
| Unrecorded .....              | 540               | 540   |
| Coal, (Lower Freeport).....   | 4                 | 544   |
| Unrecorded .....              | 56                | 600   |
| Gas sand.....                 | 70                | 670   |
| Coal, (Lower Kittanning)..... | 10                | 680   |
| Unrecorded .....              | 30                | 710   |
| Sand, (II Cow Run).....       | 20                | 730   |
| Unrecorded .....              | 45                | 775   |
| Salt sand (water).....        | 175               | 950   |
| Unrecorded .....              | 415               | 1365  |
| Big Lime.....                 | 80                | 1445  |
| Big injun sand (gas).....     | 80                | 1525  |
| Slate and shells.....         | 235               | 1760  |
| Grit (Berea).....             | 30                | 1790  |
| Slate and shells.....         | 90                | 1880  |
| Fifty-foot sand.....          | 85                | 1965  |
| Slate and shells.....         | 135               | 2100  |
| Red rock and shells.....      | 200               | 2300  |
| Sand, (Fifth).....            | 65                | 2365  |
| Slate and shells.....         | 35                | 2400  |
| Bayard sand.....              | 20                | 2420  |
| Unrecorded .....              | 30                | 2450  |
| Slate to bottom.....          | 99                | 2549  |

"Pulled casing, but got enough gas to run a family at present, estimated at 10,000 to 15,000 cu. ft. daily from Big Injun."

The above well starts 97' by hand-level below the Pittsburgh coal, according to Reger.

### John B. Cather No. 1 Well Record (711).

Flemington district, 1.9 miles northwest of Flemington. Authority, Flemington Oil & Gas Company.

| (Elevation, 1140' B-A. T.)    | Thickness. Total. |       |
|-------------------------------|-------------------|-------|
|                               | Feet.             | Feet. |
| Unrecorded .....              | 420               | 420   |
| Coal, (Upper Freeport).....   | 4                 | 424   |
| Unrecorded .....              | 6                 | 430   |
| Sand .....                    | 37                | 467   |
| Unrecorded .....              | 35                | 502   |
| Sand .....                    | 18                | 520   |
| Unrecorded .....              | 7                 | 527   |
| Coal, (Upper Kittanning)..... | 8                 | 535   |
| Unrecorded .....              | 15                | 550   |
| Sand .....                    | 15                | 565   |



|  | Thickness. | Total |
|--|------------|-------|
|  | Feet.      | Feet. |
| Unrecorded .....                                       | 10         | 575   |
| Sand .....   | 85         | 660   |
| Coal, (Clarion) .....                                  | 6          | 666   |
| Unrecorded .....                                       | 2          | 668   |
| Sand, II Cow Run and Salt (water, 700' and 785') ..... | 297        | 965   |
| Unrecorded .....                                       | 120        | 1085  |
| Maxton sand .....                                      | 30         | 1115  |
| Unrecorded .....                                       | 130        | 1245  |
| Little Lime .....                                      | 20         | 1265  |
| Unrecorded .....                                       | 15         | 1280  |
| Big Lime .....   | 80         | 1360  |
| Big Injun sand .....                                   | 88         | 1448  |
| Unrecorded .....                                       | 328        | 1776  |
| Fifty-foot sand (little gas, 1788') .....              | 109        | 1885  |
| Unrecorded .....                                       | 237        | 2122  |
| Sand, (Fourth) .....                                   | 7          | 2129  |
| Unrecorded .....                                       | 93         | 2222  |
| Sand, (Fifth) .....                                    | 14         | 2236  |
| Unrecorded to bottom .....                             | 3          | 2239  |

"Initial gas volume, about 150,000 cu. ft. daily from the Fifty-foot sand."

The above well starts about 200 feet below the Pittsburgh coal.

The detailed log of the **Pittsvein Coal Co. No. 1 well (713)**, located  $\frac{1}{4}$  mile north of Flemington, is published on pages 340-342 of Vol 1(A) of the State Survey reports. This well starts 22 feet by hand-level below the Pittsburgh coal. The well was drilled to a depth of 559 $\frac{1}{2}$  feet below the Bayard sand and only a light flow of gas encountered in the Big Injun.

The detailed log of the **Mrs. H. P. Davidson No. 1 well (712)**, located on Berry run, 1.5 miles northwest of Flemington, is published on pages 339-340 of Vol I(A) of the State Survey reports. The well starts about 220 feet below the Pittsburgh coal, so that the correlations of the coal beds as published in the report mentioned should be modified slightly. Light gas pays were encountered in the Big Injun and Fifth sands.

No information was obtained for the **Martin L. Shields No. 1 well (710)**, located on Left fork of Berry run, 1.5 miles north of Rosemont, except that it was drilled by the Flemington Oil & Gas Company, and starts 165 feet below the Pittsburgh coal, according to Reger.

**Prospective Oil and Gas Areas, Flemington District.**—As mentioned at the beginning of the discussion of this district, drilling there has not been of a very encouraging nature to the oil and gas operator. However, there yet remains a large acreage that warrants the drilling of more test wells. (1) That territory in the northwest corner of the district, lying to the west of the dividing ridge on the east side of Jerry run, appears favorable for gas in the Big Injun, Fifth and Bayard sands; (2), that along the main valley of Simpson creek, westward from Rosemont, for gas in the same horizons; and (3) that along the axis of the Ligonier synicline southward from the B. & O. R. R. at Flemington to the Taylor-Barbour county line is favorably located from a structural standpoint for oil in one of the sands below the Big Injun on account of their non-water bearing qualities. However, the risk would be great, since no paying well of either oil or gas has yet been drilled along the axis of this basin to the writer's knowledge to the northeast, either in Pennsylvania or West Virginia. It is quite probable that the conditions leading to the genesis of these hydro-carbons never prevailed along the axis of this fold, or if so, the faults and cracks associated with intense folding of mountain regions has permitted the same to escape into the air.

#### ***Courthouse District.***

Courthouse district, Taylor county, lies immediately south of Booths Creek district, and east of Flemington. Its entire area lies in the Ligonier Basin. By far the greater portion lies on the east side of the axis of this fold. Five wells have been drilled therein for oil and gas, one of which was a gasser in the Fifth sand. The detailed log of this well—the **Hugh Evans No. 1 (714)**, located 1.2 miles southwest of Prunytown—is published on page 338 of Vol. I(A) of the State Survey reports. The well mouth is about 235 feet below the Pittsburgh coal; hence, the coal correlations as given in Vol. I(A) are correct. Its initial gas volume from the Fifth sand was 400,000 cubic feet daily. A light show of gas was encountered in the Stray.

The three following records are from wells in this district.

**Sarah E. Whitescarver No. 1 Well Record (715).**

Courthouse district, 2.4 miles southwest of Pruntytown. Authority, John T. McGraw.

|                                  | Thickness. Total. |       |
|----------------------------------|-------------------|-------|
|                                  | Feet.             | Feet. |
| (Elevation, 1115' B-A. T.)       |                   |       |
| Unrecorded .....                 | 500               | 500   |
| Coal, (Upper Kittanning).....    | 6                 | 506   |
| Unrecorded .....                 | 4                 | 510   |
| Sand .....                       | 30                | 540   |
| Unrecorded .....                 | 150               | 690   |
| Coal, (Upper Mercer).....        | 8                 | 698   |
| Unrecorded .....                 | 20                | 718   |
| Coal, (Lower Mercer).....        | 5                 | 723   |
| Unrecorded .....                 | 62                | 785   |
| Salt sand (water, 890').....     | 111               | 896   |
| Unrecorded .....                 | 471               | 1367  |
| Big Lime.....                    | 85                | 1452  |
| Big Injun sand (gas, 1462')..... | 123               | 1575  |
| Unrecorded .....                 | 325               | 1900  |
| Fifty-foot sand.....             | 15                | 1915  |
| Unrecorded .....                 | 395               | 2310  |
| Fifth sand (gas show).....       | 30                | 2340  |
| Unrecorded to bottom.....        | 130               | 2470  |
| 10" casing, 220'.                |                   |       |

The above well was abandoned as a dry hole, although gas shows were struck in the Big Injun and Fifth sands. It starts 250 feet below the Pittsburgh coal.

**Clare F. Shafer No. 1 Well Record (715A).**

Courthouse district, 2.4 miles southwest of Pruntytown. Authority, Home Drilling Company. Completed during 1912.

|                                | Thickness. Total. |       |
|--------------------------------|-------------------|-------|
|                                | Feet.             | Feet. |
| (Elevation, 1240' B-A. T.)     |                   |       |
| Conductor .....                | 10                | 10    |
| Unrecorded (water, 25').....   | 30                | 40    |
| Sand .....                     | 20                | 60    |
| Unrecorded (water, 150').....  | 380               | 440   |
| Coal, (Bakerstown) .....       | 2                 | 442   |
| Unrecorded .....               | 68                | 510   |
| Sand (salt water, 520').....   | 25                | 535   |
| Unrecorded .....               | 90                | 625   |
| Sand .....                     | 40                | 665   |
| Unrecorded .....               | 70                | 735   |
| Coal, (Upper Kittanning).....  | 3                 | 738   |
| Unrecorded .....               | 14                | 752   |
| Sand .....                     | 41                | 793   |
| Unrecorded .....               | 2                 | 795   |
| Coal, (Lower Kittanning) ..... | 3                 | 798   |
| Unrecorded .....               | 29                | 827   |
| Sand, (II Cow Run).....        | 30                | 857   |
| Unrecorded .....               | 18                | 875   |
| Sand (water, 885').....        | 10                | 885   |

|                            | Thickness.<br>Feet. | Total<br>Feet. |
|----------------------------|---------------------|----------------|
| Coal, (Upper Mercer).....  | 4                   | 889            |
| Unrecorded .....           | 66                  | 955            |
| Sand .....                 | 55                  | 1010           |
| Unrecorded .....           | 130                 | 1140           |
| Sand .....                 | 40                  | 1180           |
| Unrecorded .....           | 90                  | 1270           |
| Sand .....                 | 25                  | 1295           |
| Unrecorded .....           | 55                  | 1350           |
| Sand .....                 | 20                  | 1370           |
| Unrecorded .....           | 130                 | 1500           |
| Big Lime .....             | 72                  | 1572           |
| Big Injun sand .....       | 95                  | 1667           |
| Unrecorded .....           | 343                 | 2010           |
| Fifty-foot sand .....      | 40                  | 2050           |
| Unrecorded .....           | 25                  | 2075           |
| Thirty-foot sand .....     | 15                  | 2090           |
| Unrecorded .....           | 25                  | 2115           |
| Gordon Stray sand .....    | 6                   | 2121           |
| Unrecorded .....           | 7                   | 2128           |
| Gordon sand .....          | 6                   | 2134           |
| Unrecorded .....           | 301                 | 2435           |
| Fifth sand .....           | 55                  | 2490           |
| Unrecorded .....           | 50                  | 2540           |
| Bayard sand .....          | 45                  | 2585           |
| Unrecorded to bottom ..... | 12                  | 2597           |

The above well starts near the horizon of the Pittsburgh coal. It was abandoned as a dry hole.

### M. Rector No. 1 Well Record (718).

Courthouse district, 2 miles southwest of Grafton. Authority, E. L. Rector.

| (Elevation, 985' L.A.T.)                       | Thickness.<br>Feet. | Total<br>Feet. |
|--|---------------------|----------------|
| Unrecorded .....                               | 196                 | 196            |
| Coal, (Upper Kittanning) .....                 | 8                   | 204            |
| Unrecorded .....                               | 92                  | 296            |
| Coal, (Clarion).....                           | 11                  | 307            |
| Unrecorded .....                               | 1293                | 1600           |
| Big Injun sand (some oil) and unrecorded ..... | 600                 | 2200           |
| Trenton rock and unrecorded .....              | 315                 | 2515           |
| Gordon? sand (signs of oil) .....              | ..                  | ..             |

### Prospective Oil and Gas Territory, Courthouse District.—

While the structure is favorable for oil in the deep non-water bearing sands in this district in the vicinity of Wendel, yet the dry hole (715A) on the Clare F. Shafer farm, and another (713),  $\frac{1}{4}$  mile north of Flemington, makes it appear rather doubtful whether there is an oil pool associated with the gas

field to the northwest along the Booths Creek-Courthouse district line; in other words, gas pools often occur without any apparent connection with an oil pool, but it rarely happens that a gas field is not associated with oil producing territory. In the eastern portion of the district the strata rise rapidly eastward on the west slope of the Hiram anticline, furnishing the necessary relief to aid the segregation of oil and gas into commercial pools, but the dry holes northward from Webster and the one at Stonehouse make the presence of these hydrocarbons in paying quantity quite problematical.

### *Fetterman District.*

Fetterman district occupies the northeast corner of Taylor county, hence, almost its entire area lies along the steep southeastern slope of the great Chestnut Ridge anticline. The southeast portion is traversed in a northeast-southwest direction by the axes of the Ligonier syncline and the Hiram anticline. No wells have ever been drilled for oil or gas within its boundaries. Just across the county line in the edge of Preston, 0.5 mile southeast of Irondale, a dry hole (720) was drilled on the Debillier farm by a Baltimore, Md., corporation, in which a showing of oil and gas is reported in the Salt sand. The total depth of the well was not ascertained.

#### **Prospective Oil and Gas Areas, Fetterman District.—**

The writer is inclined to class that portion of Fetterman district on the north side of the axis of the Ligonier syncline, as outlined on Map II, as quite doubtful or risky territory from an oil and gas standpoint. In the extreme southeastern portion, however, structure is quite favorable for gas along the crest of the comparatively low Hiram anticline.

### *Knottsville District.*

Knottsville district occupies the southeast corner of Taylor county, and its area is traversed in a northeast-southwest direction by the Hiram anticline. By far the greater portion of the district lies on the western slope of this fold. Considerable relief prevails therein since the Pittsburgh coal horizon varies from 1575' A.T., south of Grafton, to over 2000' A.T.,

northeast of Hiram. Only two wells, both of which were dry, have ever been drilled for oil and gas within the boundaries.

The **Newton Grimes No. 1 well (722)**, located near the southeast edge of Grafton and drilled several years ago by a local company, was a dry hole. No information was obtained for the same.

The **Lucinda McDaniel Heirs No. 1 well (726)**, the log of which was published in connection with the Stonehouse section, was drilled to a depth of 2502 feet—3175 feet below the Pittsburgh coal horizon—without getting either oil or gas. A big flow of water was encountered near the middle of the Big Lime, and another flow near the top of the Gantz sand, the latter being an unusual feature for the sands below the Big Injun in the western portion of the State.

**Prospective Oil and Gas Territory, Knottsville District.—**

The two dry holes already mentioned for this district along its western border do not lend encouragement to the oil and gas operator in that region. However, there is a large acreage within its boundaries that appears to be so favored by structure as to warrant the drilling of two or three test wells. (1) That territory immediately south and southwest of Knottsville on the waters of Swamp run appears to be located over a structural terrace on the west slope of the Hiram anticline and for that reason may probably hold an oil pool, but for reasons given under the discussion of Flemington district, the risk on an investment in a test well thereon would be great; and (2) that, along the crest of the Hiram anticline for one-half mile each side of the axis of the fold appears favorable for gas.

## CHAPTER XII.

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### COAL.

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The stratigraphic position, structure and character of the coal beds have already been discussed on preceding pages of this report. The purpose of this chapter is to give a more detailed account of the chemical composition and character of the apparent commercial coals, as well as their probable available area in the three counties.

#### STATISTICS OF COAL PRODUCTION.

In the territory of this report coal mining on a commercial scale has been confined to six beds; viz., Sewickley, Pittsburgh, Upper Freeport, Upper Kittanning, Lower Kittanning and Upper Mercer. As mentioned on preceding pages, all the minable coals lie deep below drainage in the western portions of Monongalia and Marion counties, but in the eastern portions of the same and in Taylor, the Wolf Summit, Indiana and Chestnut Ridge anticlines have all combined to elevate these beds above drainage, rendering them easily accessible to drift or slope openings; hence, all the coal developments therein have been confined largely to these localities.

The following tables are compiled from the Annual Report of John Laing, Chief of the Department of Mines of West Virginia, for the year ending June 30, 1911:

**Coal Production of Marion County from  
1888 to 1911 inclusive.**

| Year.     | Tons of<br>2240 lbs. | Year.      | Tons of<br>2240 lbs. |
|-----------|----------------------|------------|----------------------|
| 1888..... | 253,675              | 1901.....  | 2,674,553            |
| 1889..... | 245,899              | 1902.....  | 3,172,194            |
| 1890..... | 406,900              | 1903.....  | 2,668,914            |
| 1891..... | 722,594              | 1904.....  | 2,785,350            |
| 1892..... | 903,896              | 1905.....  | 3,251,999            |
| 1893..... | 958,296              | 1906.....  | 3,629,805            |
| 1894..... | 1,186,542            | 1907.....  | 3,619,764            |
| 1895..... | 1,198,336            | 1908.....  | 3,440,666            |
| 1896..... | 1,219,017            | 1909.....  | 3,733,765            |
| 1897..... | 1,368,682            | 1910.....  | 4,210,822            |
| 1898..... | 1,639,625            | 1911.....  | 4,084,822            |
| 1899..... | 2,392,983            |            |                      |
| 1900..... | 2,925,907            | Total..... | 52,694,806           |

**Coal Production of Monongalia County from  
1888 to 1911 inclusive.**

| Year.     | Tons of<br>2240 lbs. | Year.      | Tons of<br>2240 lbs. |
|-----------|----------------------|------------|----------------------|
| 1888..... | .....                | 1901.....  | 75,589               |
| 1889..... | 6,850                | 1902.....  | 130,371              |
| 1890..... | 28,000               | 1903.....  | 148,074              |
| 1891..... | 46,100               | 1904.....  | 194,540              |
| 1892..... | 70,062               | 1905.....  | 178,752              |
| 1893..... | 97,905               | 1906.....  | 196,074              |
| 1894..... | 62,125               | 1907.....  | 292,596              |
| 1895..... | 47,653               | 1908.....  | 271,843              |
| 1896..... | 52,080               | 1909.....  | 235,816              |
| 1897..... | 31,288               | 1910.....  | 414,992              |
| 1898..... | 68,867               | 1911.....  | 464,319              |
| 1899..... | 56,793               |            |                      |
| 1900..... | 82,148               | Total..... | 3,252,837            |

**Coal Production of Taylor County from  
1888 to 1911 inclusive.**

| Year.     | Tons of<br>2240 lbs. | Year.      | Tons of<br>2240 lbs. |
|-----------|----------------------|------------|----------------------|
| 1888..... | 66,439               | 1901.....  | 383,223              |
| 1889..... | 177,901              | 1902.....  | 415,502              |
| 1890..... | 68,403               | 1903.....  | 264,524              |
| 1891..... | 83,851               | 1904.....  | 234,502              |
| 1892..... | 74,000               | 1905.....  | 252,161              |
| 1893..... | 68,928               | 1906.....  | 398,563              |
| 1894..... | 72,229               | 1907.....  | 416,138              |
| 1895..... | 86,536               | 1908.....  | 396,358              |
| 1896..... | 43,469               | 1909.....  | 437,633              |
| 1897..... | 178,397              | 1910.....  | 583,222              |
| 1898..... | 109,532              | 1911.....  | 634,462              |
| 1899..... | 249,103              |            |                      |
| 1900..... | 376,030              | Total..... | 6,071,106            |



## Order of Counties in the Production of Coal, 1897-1911.

| Counties.  | 1897 | 1898 | 1899 | 1900 | 1901 | 1902 | 1903 | 1904 | 1905 | 1906 | 1907 | 1908 | 1909 | 1910 | 1911 |
|------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Fayette    | 1    | 1    | 1    | 1    | 1    | 1    | 2    | 1    | 2    | 2    | 2    | 2    | 2    | 2    | 2    |
| McDowell   | 2    | 2    | 2    | 2    | 2    | 2    | 1    | 2    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| Marion     | 3    | 3    | 3    | 3    | 3    | 3    | 3    | 4    | 3    | 4    | 4    | 4    | 4    | 4    | 4    |
| Kanawha    | 4    | 4    | 4    | 4    | 4    | 4    | 5    | 3    | 4    | 3    | 3    | 3    | 3    | 3    | 3    |
| Mercer     | 5    | 5    | 5    | 6    | 6    | 6    | 6    | 6    | 6    | 6    | 6    | 6    | 6    | 6    | 6    |
| Harrison   | 9    | 9    | 8    | 7    | 5    | 5    | 4    | 5    | 5    | 5    | 5    | 5    | 5    | 5    | 5    |
| Tucker     | 6    | 6    | 7    | 5    | 7    | 7    | 7    | 8    | 8    | 8    | 10   | 10   | 10   | 10   | 10   |
| Mingo      | 8    | 8    | 9    | 9    | 9    | 8    | 8    | 7    | 7    | 7    | 7    | 7    | 9    | 9    | 9    |
| Mineral    | 7    | 7    | 6    | 8    | 8    | 9    | 11   | 11   | 12   | 13   | 14   | 13   | 11   | 13   | 15   |
| Preston    | 13   | 11   | 10   | 10   | 10   | 10   | 9    | 10   | 10   | 9    | 9    | 11   | 13   | 11   | 11   |
| Taylor     | 10   | 10   | 11   | 11   | 11   | 11   | 14   | 16   | 16   | 16   | 17   | 17   | 16   | 15   | 14   |
| Marshall   | 11   | 12   | 12   | 12   | 13   | 16   | 13   | 14   | 14   | 15   | 15   | 18   | 19   | 16   | 18   |
| Randolph   | ...  | ...  | ...  | 14   | 14   | 14   | 12   | 13   | 13   | 12   | 13   | 14   | 14   | 14   | 13   |
| Barbour    | 19   | 19   | 17   | 18   | 12   | 12   | 10   | 9    | 11   | 11   | 11   | 12   | 12   | 12   | 13   |
| Raleigh    | 16   | 16   | 16   | 19   | 17   | 13   | 15   | 12   | 9    | 10   | 8    | 8    | 8    | 6    | 6    |
| Putnam     | 12   | 13   | 13   | 13   | 15   | 15   | 16   | 15   | 15   | 14   | 13   | 16   | 17   | 17   | 17   |
| Ohio       | 15   | 15   | 14   | 15   | 16   | 17   | 18   | 19   | 21   | 22   | 21   | 21   | 21   | 20   | 20   |
| Brooke     | 17   | 18   | 18   | 20   | 20   | 20   | 23   | 22   | 17   | 17   | 16   | 15   | 15   | 18   | 15   |
| Mason      | 14   | 14   | 15   | 16   | 18   | 19   | 19   | 20   | 22   | 21   | 22   | 22   | 22   | 22   | 22   |
| Grant      | ...  | ...  | ...  | ...  | ...  | ...  | 22   | 18   | 19   | 19   | 20   | 20   | 20   | 21   | 21   |
| Logan      | ...  | ...  | ...  | ...  | ...  | ...  | ...  | 20   | 18   | 12   | 9    | 7    | 8    | 7    | 7    |
| Monongalia | 20   | 17   | 19   | 17   | 19   | 18   | 17   | 17   | 18   | 20   | 19   | 19   | 18   | 19   | 19   |
| Hancock    | 18   | 20   | 20   | 21   | 21   | 21   | 20   | 21   | 24   | 24   | 23   | 25   | 26   | 24   | 27   |
| Clay       | ...  | ...  | ...  | ...  | ...  | ...  | ...  | 25   | 23   | 23   | 24   | 27   | 30   | 30   | 25   |
| Nicholas   | ...  | ...  | ...  | ...  | ...  | 22   | 24   | 24   | 25   | 25   | 25   | 26   | 27   | 26   | 24   |
| Lincoln    | ...  | ...  | ...  | ...  | ...  | 23   | 21   | 23   | 27   | 26   | 30   | 30   | 25   | 28   | 28   |
| Braxton    | ...  | ...  | ...  | ...  | ...  | ...  | ...  | ...  | ...  | ...  | 28   | 23   | 23   | 23   | 23   |
| Wayne      | ...  | ...  | ...  | ...  | ...  | ...  | ...  | ...  | 26   | 27   | 29   | 29   | 28   | 29   | 32   |
| Upshur     | ...  | ...  | ...  | ...  | ...  | ...  | ...  | ...  | ...  | 28   | 27   | 24   | 24   | 25   | 29   |
| Greenbrier | ...  | ...  | ...  | ...  | ...  | ...  | ...  | ...  | ...  | ...  | 28   | 28   | 29   | 32   | 30   |
| Lewis      | ...  | ...  | ...  | ...  | ...  | ...  | ...  | ...  | ...  | ...  | 31   | 31   | 32   | 33   | 33   |
| Gilmer     | ...  | ...  | ...  | ...  | ...  | ...  | ...  | ...  | ...  | ...  | 32   | 32   | 31   | 31   | 31   |
| Wyoming    | ...  | ...  | ...  | ...  | ...  | ...  | ...  | ...  | ...  | ...  | ...  | 33   | 34   | 34   | ...  |
| Boone      | ...  | ...  | ...  | ...  | ...  | ...  | ...  | ...  | ...  | ...  | ...  | ...  | 33   | 27   | 26   |

Production of Coal and Coke in Monongalia County for the Year Ending June 30, 1911.

| COMPANY                      | MINE                   | PRODUCTION OF COAL<br>(Tons of 2240 lbs.) |                       |                                    |                                 | DISTRIBUTION OF COAL<br>(Tons of 2240 lbs.) |                          |                                   |                      |                       |                          | PRODUCTION OF COKE<br>(Tons of 2000 lbs.) |  |  |
|------------------------------|------------------------|---|-----------------------|------------------------------------|---------------------------------|---|--------------------------|-----------------------------------|----------------------|-----------------------|--------------------------|---|--|--|
|                              |                        | First<br>6<br>Months                      | Second<br>6<br>Months | Total Coal<br>Produced<br>for Year | Used in<br>Operation<br>of Mine | Furnished<br>Local<br>Trains and<br>Tonnage | Used in<br>Coke<br>Ovens | Quantity<br>Shipped from<br>Mines | First<br>6<br>Months | Second<br>6<br>Months | Total<br>for the<br>Year |   |  |  |
| Consolidation Coal Co.       | No. 30                 | 36,592                                    | 20,263                | 56,855                             | 260                             | 176   | .....                    | 56,419                            | .....                | .....                 | .....                    | .....                                     |  |  |
| Elkins Coal & Coke Co.       | Richard No. 1.         | 55,796                                    | 39,583                | 95,379                             | 1,640                           | 276   | 71,205                   | 22,258                            | 23,898               | 24,581                | 48,479                   | .....                                     |  |  |
| Elkins Coal & Coke Co.       | Elkins No. 3.          | .....                                     | 7,874                 | 7,874                              | .....                           | .....                                       | .....                    | 7,874                             | .....                | .....                 | .....                    | .....                                     |  |  |
| Elkins Coal & Coke Co.       | Sabraton No. 5         | 65,299                                    | 69,336                | 134,635                            | .....                           | 164   | .....                    | 134,471                           | .....                | .....                 | .....                    | .....                                     |  |  |
| Connellsville Basin Coke Co. | Connellsville<br>Basin | 70,077                                    | 67,336                | 137,413                            | 6,000                           | 462   | 130,951                  | .....                             | 41,777               | 39,719                | 81,496                   | .....                                     |  |  |
| Great Scott Coal Co.         | Great Scott.           | 6,820                                     | 5,360                 | 11,980                             | 50                              | 4,500                                       | .....                    | 7,430                             | .....                | .....                 | .....                    | .....                                     |  |  |
| Antler Coal Co.              | Grant                  | .....                                     | 13,093                | 13,093                             | .....                           | 28  | .....                    | 13,068                            | .....                | .....                 | .....                    | .....                                     |  |  |
| Pittsburgh Steam Coal Co.    | Opekiska               | 3,949                                     | 3,141                 | 7,090                              | 42                              | 215   | 1,537                    | 5,296                             | .....                | 960                   | 960                      | .....                                     |  |  |
| Totals                       | .....                  | 238,333                                   | 225,986               | 464,319                            | 7,992                           | 5,818                                       | 203,693                  | 246,816                           | 65,675               | 65,260                | 130,935                  | .....                                     |  |  |

## Production of Coal and Coke in Marion County for the Year Ending June 30, 1911.

| COMPANY                          | MINE                    | PRODUCTION OF COAL<br>(Tons of 2240 lbs.) |                       |                                    | DISTRIBUTION OF COAL<br>(Tons of 2240 lbs.) |  |                          |                                   | PRODUCTION OF COKE<br>(Tons of 2000 lbs.) |                       |                          |
|----------------------------------|-------------------------|---|-----------------------|------------------------------------|---|--|--------------------------|-----------------------------------|---|-----------------------|--------------------------|
|                                  |                         | First<br>6<br>Months                      | Second<br>6<br>Months | Total Coal<br>Produced<br>for Year | Used in<br>Operation<br>of Mine             | Furnished<br>Local<br>Trade and<br>Tenants | Used in<br>Coke<br>Ovens | Quantity<br>Shipped from<br>Mines | First<br>6<br>Months                      | Second<br>6<br>Months | Total<br>for the<br>Year |
| Consolidation Coal Co.           | No. 22                  | 94,664                                    | 58,851                | 153,515                            | 1,500                                       | 2,011                                      | 160,004                  | 160,004                           |   |                       |                          |
| Consolidation Coal Co.           | No. 24                  | 85,930                                    | 54,078                | 140,008                            | 5,217                                       | 722  | 134,069                  | 134,069                           |   |                       |                          |
| Consolidation Coal Co.           | No. 26                  | 147,364                                   | 88,894                | 236,258                            | 8,369                                       | 1,960                                      | 225,929                  | 225,929                           |   |                       |                          |
| Consolidation Coal Co.           | No. 28                  | 60,946                                    | 49,053                | 109,999                            | 1,440                                       | 205  | 108,354                  | 108,354                           |   |                       |                          |
| Consolidation Coal Co.           | No. 34                  | 41,173                                    | 36,896                | 78,069                             | 528   |  | 77,541                   | 77,541                            |   |                       |                          |
| Consolidation Coal Co.           | No. 36                  | 104,401                                   | 69,178                | 173,579                            |   | 296  |                          | 173,283                           |   |                       |                          |
| Consolidation Coal Co.           | No. 38                  | 110,228                                   | 76,082                | 186,290                            | 8,260                                       | 1,416                                      | 176,614                  | 176,614                           |   |                       |                          |
| Consolidation Coal Co.           | No. 43                  | 108,072                                   | 101,743               | 209,830                            | 7,200                                       |  | 36,865                   | 166,765                           | 20,825                                    | 3,752                 | 24,577                   |
| Consolidation Coal Co.           | No. 45                  | 47,152                                    | 26,532                | 73,684                             | 2,125                                       | 466  |                          | 71,093                            |   |                       |                          |
| Consolidation Coal Co.           | No. 47                  | 93,975                                    | 58,097                | 152,072                            | 461   | 131  |                          | 151,480                           |   |                       |                          |
| Consolidation Coal Co.           | No. 53                  | 82,690                                    | 47,589                | 130,279                            | 480   |  |                          | 129,799                           |   |                       |                          |
| Consolidation Coal Co.           | No. 56                  | 111,481                                   | 58,763                | 170,244                            | 4,473                                       | 632  |                          | 165,189                           |   |                       |                          |
| Consolidation Coal Co.           | No. 59                  | 36,646                                    | 16,014                | 52,660                             | 1,248                                       | 85   |                          | 51,327                            |   |                       |                          |
| Consolidation Coal Co.           | No. 63                  | 125,125                                   | 109,286               | 234,411                            | 2,400                                       |  | 24,659                   | 207,352                           | 502                                       | 12,157                | 12,659                   |
| Consolidation Coal Co.           | No. 67                  | 47,376                                    | 28,745                | 76,121                             | 1,031                                       | 451  |                          | 74,639                            |   |                       |                          |
| Consolidation Coal Co.           | No. 68                  | 79,495                                    | 81,583                | 161,078                            | 980   |  |                          | 159,522                           |   |                       |                          |
| Consolidation Coal Co.           | Nichol's Farm           | 567                                       | 603                   | 1,170                              |   | 1,170                                      |                          |                                   |   |                       |                          |
| Kilgarn Coal & Coke Co.          | Kilgarn Nos.<br>1 & 2   | 13,850                                    | 2,175                 | 16,025                             |   | 117  |                          | 15,908                            |   |                       |                          |
| Jamison Coal & Coke Co.          | Jamison No. 7           | 45,143                                    | 94,152                | 139,295                            | 2,592                                       | 342  |                          | 136,361                           |   |                       |                          |
| Jamison Coal & Coke Co.          | Jamison No. 8           | 172,366                                   | 190,375               | 362,741                            | 1,464                                       |  | 354                      | 352,856                           | 2,295                                     | 3,135                 | 5,480                    |
| Jamison Coal & Coke Co.          | Jamison No. 9           | 41,234                                    | 77,652                | 118,886                            |   | 328  |                          | 118,558                           |   |                       |                          |
| Harry B. Coal Co.                | Harry B.,<br>Nos. 1 & 2 | 20,611                                    | 23,149                | 43,760                             |   | 50   |                          | 43,710                            |   |                       |                          |
| Va. & Pittsburgh Coal & Coke Co. | Kingmont                | 148,276                                   | 152,492               | 300,768                            | 1,700                                       | 1,500                                      | 4,739                    | 292,829                           | 1,502                                     | 1,460                 | 2,962                    |
| Four States Coal & Coke Co.      | Annabelle               | 4,403                                     | 62,728                | 67,131                             | 4,500                                       | 790  |                          | 61,841                            |   |                       |                          |
| Federal Coal & Coke Co.          | Federal                 | 142,831                                   | 234,940               | 377,771                            | 15,569                                      | 1,613                                      |                          | 360,589                           |   |                       |                          |
| New Central Coal Co.             | Stafford                | 132,362                                   | 111,665               | 245,027                            | 10,587                                      | 1,821                                      |                          | 232,619                           |   |                       |                          |
| Pittsburgh Steam Coal Co.        | Elizabeth               | 20,418                                    | 8,818                 | 29,236                             |   |  |                          | 29,236                            |   |                       |                          |
| Catawba Coal Co.                 | Catawba                 | 8,923                                     | 6,696                 | 15,619                             |   |  |                          | 15,619                            |   |                       |                          |
| Dakota Coal & Coke Co.           | Dakota, Nos.<br>1 & 2   | 2,667                                     | 11,605                | 14,272                             | 2,479                                       | 431  |                          | 11,362                            |   |                       |                          |
| Phillips Coal Co.                | Phillips                | 6,821                                     | 8,203                 | 15,024                             |   |  |                          | 15,024                            |   |                       |                          |
| Total                            |                         | 2,138,205                                 | 1,946,917             | 4,084,822                          | 84,603                                      | 17,467                                     | 74,330                   | 3,308,422                         | 26,124                                    | 20,504                | 45,628                   |

Production of Coal and Coke in Taylor County for the Year Ending June 30, 1911.

| COMPANY                 | MINE                          | PRODUCTION OF COAL<br>(Tons of 2240 lbs.) |                       |                                    | DISTRIBUTION OF COAL<br>(Tons of 2240 lbs.) |  |                          |                                   |                      | PRODUCTION OF COKE<br>(Tons of 2000 lbs.) |                          |  |
|-------------------------|-------------------------------|---|-----------------------|------------------------------------|---|--|--------------------------|-----------------------------------|----------------------|---|--------------------------|--|
|                         |                               | First<br>6<br>Months                      | Second<br>6<br>Months | Total Coal<br>Produced<br>for Year | Used in<br>Operation<br>of Mine             | Furnished<br>Local<br>Trade and<br>Tonnage | Used in<br>Coke<br>Ovens | Quantity<br>Shipped from<br>Mines | First<br>6<br>Months | Second<br>6<br>Months                     | Total<br>for the<br>Year |  |
| Grafton C. & C. Co.     | Sandlick                      | 18,850                                    | 16,987                | 35,837                             | 100   |  |                          | 35,737                            |                      |   |                          |  |
| Pittsvein Coal Co.      | Flemington                    | 44,917                                    | 13,051                | 57,968                             | 325   |  |                          | 57,643                            |                      |   |                          |  |
| T. B. Davis             | T. B. Davis<br>Nos. 1 & 2.    | 13,902                                    | 21,738                | 35,640                             | 99  |  |                          | 35,291                            |                      |   |                          |  |
| McGraw Coal Co.         | New York                      | 30,393                                    | 15,672                | 46,065                             | 1,271                                       |  |                          | 44,618                            |                      |   |                          |  |
| Rosemont Coal Co.       | Rosemont                      | 100,860                                   | 127,059               | 227,919                            | 655   |  |                          | 226,881                           |                      |   |                          |  |
| Maryland Coal Co.       | Wendel Nos.<br>1, 2, 3, 4 & 5 | 91,591                                    | 87,508                | 179,099                            | 2,617                                       |  |                          | 176,092                           |                      |   |                          |  |
| Winona C. & C. Co.      | Winona No. 2.                 | 11,433                                    | 5,457                 | 16,890                             | 900   |  | 4,340                    | 11,602                            | 649                  | 2,244                                     | 2,893                    |  |
| Harrison Coal Co.       | Harrison                      | 13,515                                    | 13,110                | 26,625                             |   |  |                          | 26,625                            |                      |   |                          |  |
| Sterling Coal Co., Ltd. | Cecil                         | 1,940                                     | 6,479                 | 8,419                              | 750   |  |                          | 7,625                             |                      |   |                          |  |
| Totals                  |                               | 327,401                                   | 307,061               | 634,462                            | 6,443                                       | 1,565                                      | 4,340                    | 622,114                           | 649                  | 2,244                                     | 2,893                    |  |

In the territory of this report there are 10 workable coals in addition to 27 other veins which are too thin, impure and irregular to have any economic importance. The probable minable beds in descending order are the Washington in the Dunkard series; the Waynesburg; Sewickley, Redstone and Pittsburgh in the Monongahela; the Upper Freeport, Upper Kittanning, Lower Kittanning and Clarion in the Allegheny, and the Upper Mercer in the Pottsville.

The chemical analyses and calorific results given for the coals in this report were determined by J. Berghuis-Krak, Assistant Chemist, under the supervision of B. H. Hite, Chief Chemist of the Survey. The same methods of analysis of commercial mines were employed as obtain in the Fuel Testing Department of the United States Geological Survey, the calorific value of coals being expressed in terms of British Thermal Units (B. T. U.), this unit of heat measurement representing the amount of heat required to raise one pound of water one degree Fahrenheit in temperature. In any analysis giving the B. T. U. result, the number of units represents the amount of heat stored up in one pound of coal. In addition to both the proximate and ultimate analysis and calorific tests, the table at the end of this chapter gives the ratio of the total **carbon** to the **oxygen plus ash**, the latter being the best ratio yet devised for the classification of coals in order of their relative rank as to heat value.

The apparent coals of the area will now be discussed by series in descending order.

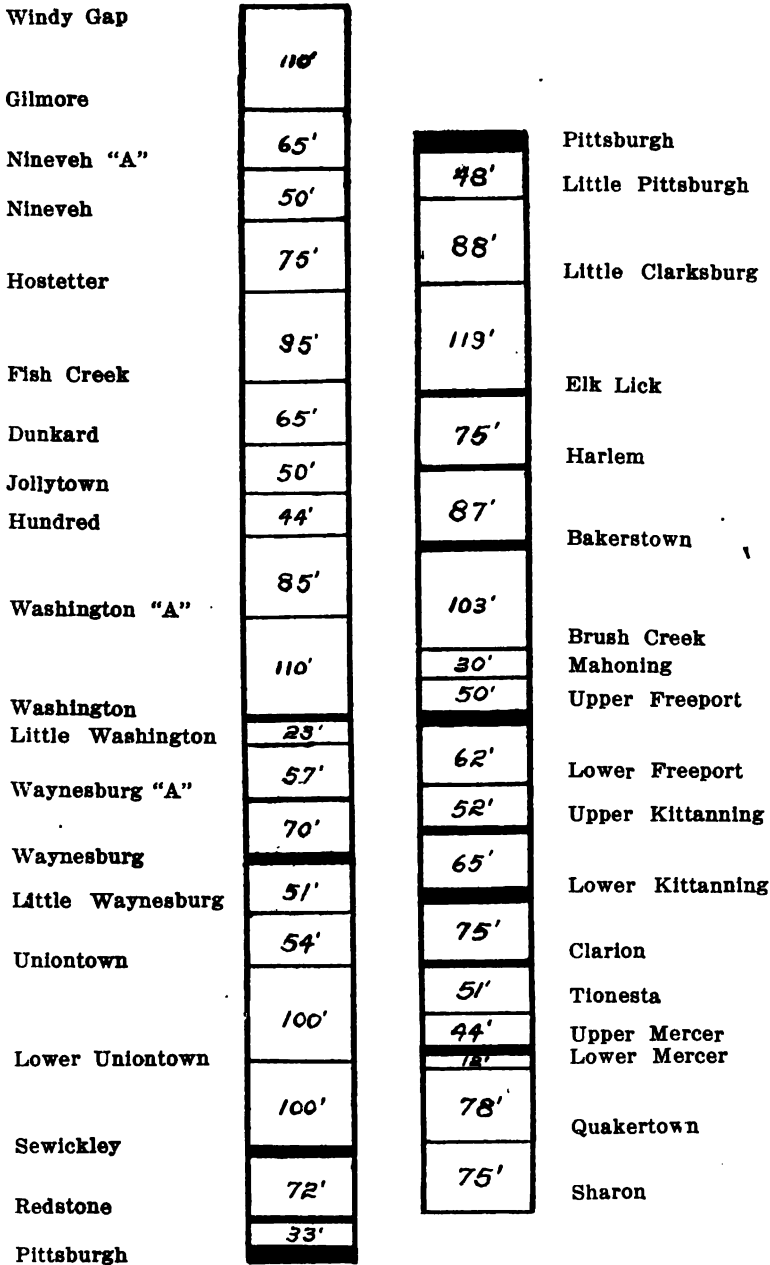
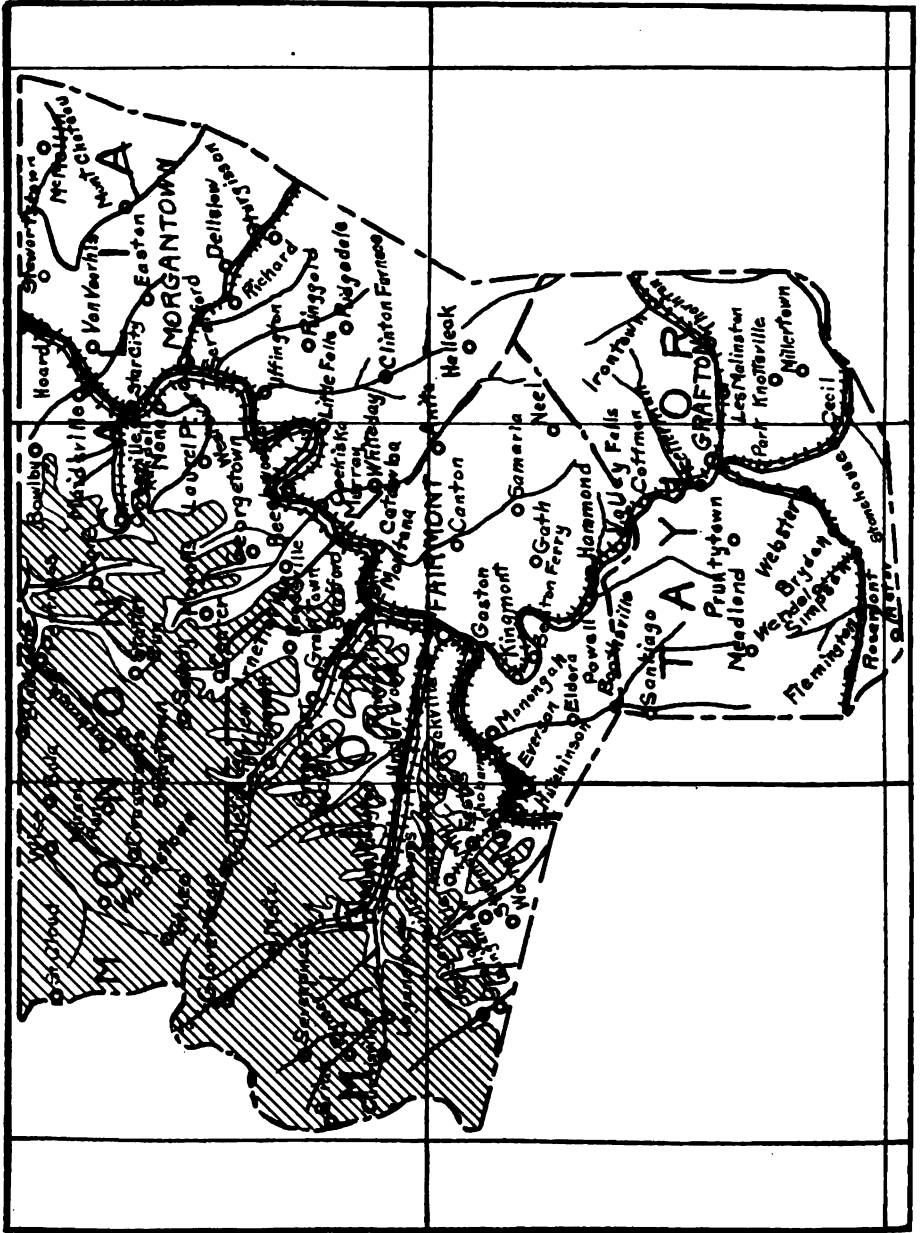


Figure 3.—Diagram showing the relative positions of coal seams.



## MINABLE COALS OF THE DUNKARD SERIES.

*The Washington Coal.*

The Washington bed appears to be the only coal in the Dunkard series to attain sufficient thickness, purity and regularity to be classed as a minable vein. Its crop is shown by an appropriate symbol on Map II. A detailed description of its thickness, character and distribution is given on pages 201-205.

**Quantity of Washington Coal Available.**

Owing to the fact that the Washington coal lies deeply buried below drainage in the western portions of Monongalia and Marion counties the only data available to determine its thickness and regularity were the records of wells bored for oil and gas in this region. Unfortunately the drillers, being more interested in the oil sands and their main "key rock," the Pittsburgh coal, quite generally fail to record other coals; hence, even these data are quite meager. The following is a list of wells recording depth and thickness of the Washington bed.

**List of Wells Recording Washington Coal.**

| No. on Map.               | NAME OF WELL.          | LOCATION.                     | WASHINGTON COAL.               |             |                 |
|---------------------------|------------------------|-------------------------------|--------------------------------|-------------|-----------------|
|                           |                        |                               | Elevation of Well Mouth. A. T. | Depth Feet. | Thickness Feet. |
| <b>Monongalia County:</b> |                        |                               |                                |             |                 |
| 27                        | Sol. Shriver No. 2...  | Wadestown, 1.4 m. NE.....     | 1015B                          | 275         | 4               |
| 53                        | John Estel Hrs. No. 1  | St. Leo, 1 m. N 15° E.....    | ....                           | 810         | 3               |
| 80                        | M. J. Garrison No. 1.. | Wadestown, 1.2 m. SE.....     | 1120B                          | 375         | 2               |
| <b>Marion County:</b>     |                        |                               |                                |             |                 |
| 348                       | L. A. Keenan No. 1..   | Glover Gap, 1.9 m. N 30° W... | 1135B                          | 460         | 2               |
| 354                       | A. M. Glover No. 4..   | Glover Gap, .0.6 m. NW.....   | 1160B                          | 440         | 2               |
| 371                       | Riley Arnett No. 2..   | Rymer, 1.7 m. S 85° W.....    | 1120B                          | 450         | 4               |
| 372                       | Riley Arnett No. 1..   | Rymer, 1.1 m. W.              | 1055B                          | 350         | 12              |
| 448                       | A. J. Hayes No. 8....  | Rymer, 1.1 m. NE.....         | 1300B                          | 510         | 10              |
| 600                       | L. D. Martin No. 1..   | Downs, 1.2 m. NE.....         | ....                           | 120         | ..              |



From the above data and its exposure at crop, together with reports from drillers, it seems quite safe to assume an average thickness of 2 feet spread over the entire area given in the table next below. A careful measurement of its area with planimeter on Map II gives the following results, as determined by Reger:

**Available Washington Coal.**

| Counties by Districts     | Sq. Miles     | Acres          | Cubic Feet of Coal    | Short Tons of Coal |
|---------------------------|---------------|----------------|-----------------------|--------------------|
| <b>Monongalia</b>         |               |                |                       |                    |
| Battelle .....            | 56.40         | 36,096         | 3,144,683,520         | 125,787,341        |
| Clay .....                | 57.04         | 36,506         | 3,180,402,720         | 127,216,109        |
| Cass .....                | 7.65          | 4,896          | 426,539,520           | 17,061,581         |
| Grant .....               | 6.70          | 4,288          | 373,568,560           | 14,942,742         |
| Totals .....              | 127.79        | 81,786         | 7,125,194,320.        | 285,007,773        |
| <b>Marion</b>             |               |                |                       |                    |
| Mannington .....          | 90.79         | 58,106         | 5,062,194,720         | 202,487,789        |
| Pawpaw .....              | 15.65         | 10,016         | 872,593,920           | 34,903,757         |
| Lincoln .....             | 24.01         | 15,366         | 1,338,685,920         | 53,547,437         |
| Fairmont .....            | 4.18          | 2,675          | 231,046,000           | 9,241,841          |
| Totals .....              | 134.63        | 86,163         | 7,504,520,560         | 300,180,824        |
| <b>Totals for Area...</b> | <b>262.42</b> | <b>167,949</b> | <b>14,629,714,880</b> | <b>585,188,597</b> |

To arrive at the above results, a weight of 80 pounds to the cubic foot of coal was assumed, or at the rate of 25 cubic feet to the short ton. The latter figures obtain at the Fuel Testing plant of the U. S. Geological Survey for the same amount of Pittsburgh coal.

Owing to the presence in the territory of this report of several thicker, purer and more easily accessible coals, the Washington bed is not marketable at present. When these better coals approach exhaustion, then the poorer grades will no doubt be utilized for both heat and power.

**MINABLE COALS OF THE MONONGAHELA SERIES.**

**Additional Coal Test Records.**

After this volume had gone to press, the Survey secured, through the courtesy of George T. Watson, Vice-President and General Manager, and Frank Haas, Consulting Engineer, of the Consolidation Coal Company of Fairmont, the records of eleven coal test borings that were made in Clay, Cass and

Grant districts, Monongalia county. Since these records contain much valuable information on the coals of the Monongahela series, they are published in the following pages. To save space some of the details of strata have been omitted, but the coal formations are given in full.

### E. W. Brand Coal Test No. 1 (315).

Grant district, 1 mile N 70° W of Laurel Point. Authority, Consolidation Coal Company.

|                                   | Thickness.                      |                      | Total. |     |     |   |
|-----------------------------------|---------------------------------|----------------------|--------|-----|-----|---|
|                                   | Ft.                             | In.                  | Ft.    | In. |     |   |
| (Elevation, 1005.29' L-A. T.)     |                                 |                      |        |     |     |   |
| Surface, limestone and shale..... | 46                              | 11                   | 46     | 11  |     |   |
| Sandstone, gray.....              | 35                              | 6                    | 82     | 5   |     |   |
| Slate, black.....                 | 5                               | 9                    | 88     | 2   |     |   |
| Sandstone, gray (Sewickley).....  | 28                              | 3                    | 116    | 5   |     |   |
| Slate, black.....                 | 0                               | 4                    | 116    | 9   |     |   |
| Coal.....5' 5"                    | }                               | Upper Sewickley..... | 7      | 9   | 124 | 6 |
| Slate.....0 2                     |                                 |                      |        |     |     |   |
| Fire clay....1 9                  |                                 |                      |        |     |     |   |
| Coal.....0 5                      |                                 |                      |        |     |     |   |
| Fire clay.....                    | 4                               | 0                    | 128    | 6   |     |   |
| Slate, black.....                 | 1                               | 0                    | 129    | 6   |     |   |
| Limestone.....                    | 16                              | 0                    | 145    | 6   |     |   |
| Fire clay.....                    | 3                               | 7                    | 149    | 1   |     |   |
| Coal, (Lower Sewickley).....      | 0                               | 1                    | 149    | 2   |     |   |
| Limestone.....                    | 6                               | 7                    | 155    | 9   |     |   |
| Fire clay.....                    | 4                               | 7                    | 160    | 4   |     |   |
| Limestone.....                    | 4                               | 10                   | 165    | 2   |     |   |
| Fire clay.....                    | 8                               | 0                    | 173    | 2   |     |   |
| Shale, dark, sandy.....           | 14                              | 9                    | 187    | 11  |     |   |
| Coal, (Redstone).....             | 0                               | 1                    | 188    | 0   |     |   |
| Limestone.....                    | 16                              | 0                    | 204    | 0   |     |   |
| Shale, black.....                 | 1                               | 2                    | 205    | 2   |     |   |
| Bone and coal..2' 5"              | }                               | Pittsburgh.....      | 16     | 1   | 221 | 3 |
| Slate, dark....3 2                |                                 |                      |        |     |     |   |
| Coal.....0 2                      |                                 |                      |        |     |     |   |
| Slate, black....0 8               |                                 |                      |        |     |     |   |
| Coal.....0 9                      |                                 |                      |        |     |     |   |
| Slate, dark.....0 6               | (Elevation of base,<br>784.04') |                      |        |     |     |   |
| Coal.....8 5                      |                                 |                      |        |     |     |   |
| Fire clay to bottom.....          | 0                               | 11                   | 222    | 2   |     |   |

### J. H. Cole Coal Test No. 2 (292).

Grant district, 1.5 miles S 10° E of Cassville. Authority, Consolidation Coal Company.

|   | Thickness. |     | Total. |     |
|---|------------|-----|--------|-----|
|   | Ft.        | In. | Ft.    | In. |
| (Elevation, 1057.6' L-A. T.)                                      |            |     |        |     |
| Surface, limestone and shale.....                                 | 43         | 11  | 43     | 11  |
| Slate, black (Umiontown coal).....                                | 2          | 0   | 45     | 11  |
| Limestone, shale and thin sandstone.....                          | 127        | 5   | 173    | 4   |
| Sandstone, (Sewickley).....                                       | 41         | 11  | 215    | 3   |
| Slate, black.....   | 4          | 0   | 219    | 3   |
| Coal, Upper Sewickley (Elevation of base,<br>932.6' L-A. T.)..... | 5          | 10  | 225    | 1   |
| Fire clay.....  | 6          | 0   | 231    | 1   |

|  | Thickness. |     | Total. |     |
|--|------------|-----|--------|-----|
|  | Ft.        | In. | Ft.    | In. |
| Limestone .....                        | 9          | 5   | 240    | 6   |
| Slate, dark .....                      | 7          | 3   | 247    | 9   |
| Coal, (Lower Sewickley).....           | 0          | 2   | 247    | 11  |
| Limestone .....                        | 18         | 8   | 266    | 7   |
| Fire clay .....                        | 3          | 0   | 269    | 7   |
| Limestone .....                        | 4          | 0   | 273    | 7   |
| Fire clay .....                        | 5          | 0   | 278    | 7   |
| Coal, (Redstone) .....                 | 2          | 3   | 280    | 10  |
| Shale, gray .....                      | 2          | 3   | 283    | 1   |
| Limestone .....                        | 12         | 10  | 295    | 11  |
| Slate, dark .....                      | 3          | 8   | 299    | 7   |
| Coal .....0' 6" } .....                | 14         | 2   | 313    | 9   |
| Slate, black....2 8 } Pittsburgh ..... |            |     |        |     |
| Coal .....0 2 } (Elevation of base,    |            |     |        |     |
| Slate, dark....1 4 } 743.9' L-A. T.)   |            |     |        |     |
| Coal .....0 6 } .....                  |            |     |        |     |
| Slate, black....0 10 } .....           |            |     |        |     |
| Coal .....8 2 } .....                  | 1          | 10  | 315    | 7   |
| Limestone to bottom.....               |            |     |        |     |

### Mankedick Heirs Coal Test No. 3 (267)

Cass district, 0.7 mile east of Cassville. Authority, Consolidation Coal Company.

|   | Thickness. |     | Total. |     |
|---|------------|-----|--------|-----|
|   | Ft.        | In. | Ft.    | In. |
| (Elevation, 963.05' L-A. T.)                                    |            |     |        |     |
| Surface, limestone and shale.....                               | 52         | 10  | 52     | 10  |
| Sandstone, Sewickley .....                                      | 13         | 0   | 65     | 10  |
| Slate, dark .....   | 10         | 6   | 76     | 4   |
| Coal, Upper Sewickley (Elevation of base, 882.7' L-A. T.) ..... | 4          | 0   | 80     | 4   |
| Fire clay.....  | 4          | 0   | 84     | 4   |
| Limestone .....   | 8          | 0   | 92     | 4   |
| Shale, sandy .....  | 11         | 5   | 103    | 9   |
| Slate, dark .....   | 5          | 0   | 108    | 9   |
| Coal, Lower Sewickley.....                                      | 0          | 1   | 108    | 10  |
| Slate, limestone and fire clay.....                             | 27         | 8   | 136    | 6   |
| Coal, Redstone .....  | 1          | 10  | 138    | 4   |
| Fire clay .....   | 1          | 7   | 139    | 11  |
| Limestone .....   | 15         | 3   | 155    | 2   |
| Fire clay .....   | 3          | 2   | 158    | 4   |
| Coal, bony....1' 0" } .....                                     | 15         | 1   | 173    | 5   |
| Slate, black....4 9 } Pittsburgh .....                          |            |     |        |     |
| Coal .....0 5 } (Elevation of base,                             |            |     |        |     |
| Slate .....0 11 } 789.6' L-A. T.)                               |            |     |        |     |
| Coal .....8 0 } .....   | 2          | 0   | 175    | 5   |
| Fire clay to bottom.....  |            |     |        |     |

### J. N. Michael Coal Test No. 4 (303).

Grant district, 1.8 miles northeast of Hagans. Authority, Consolidation Coal Company.

|                               | Thickness. |     | Total. |     |
|-------------------------------|------------|-----|--------|-----|
|                               | Ft.        | In. | Ft.    | In. |
| (Elevation, 1159.02' L-A. T.) |            |     |        |     |
| Surface .....                 | 4          | 0   | 4      | 0   |
| Shale, sandy .....            | 13         | 0   | 17     | 0   |
| Fire clay.....                | 30         | 0   | 47     | 0   |

|                                  | Thickness.                          |     | Total. |     |                      |
|----------------------------------|-------------------------------------|-----|--------|-----|----------------------|
|                                  | Ft.                                 | In. | Ft.    | In. |                      |
| Coal .....                       | 0'                                  | 2"  | 4      | 2   | Waynesburg "A" ..... |
| Slate, soft.....                 | 2                                   | 7   |        |     |                      |
| Coal .....                       | 1                                   | 5   |        |     |                      |
| Slate, black.....                | 0                                   | 9   | 51     | 11  |                      |
| Fire clay.....                   | 12                                  | 0   | 63     | 11  |                      |
| Shale, blue.....                 | 12                                  | 0   | 75     | 11  |                      |
| Fire clay.....                   | 20                                  | 0   | 95     | 11  |                      |
| Slate, dark.....                 | 4                                   | 7   | 100    | 6   |                      |
| Sandstone, (Waynesburg) .....    | 16                                  | 0   | 116    | 6   |                      |
| Slate, black.....                | 8                                   | 0   | 124    | 6   |                      |
| Coal .....                       | 0'                                  | 6"  | 8      | 2   | Waynesburg .....     |
| Fire clay.....                   | 1                                   | 0   |        |     |                      |
| Coal .....                       | 3                                   | 11  |        |     |                      |
| Slate .....                      | 0                                   | 3   |        |     |                      |
| Coal .....                       | 0                                   | 6   |        |     |                      |
| Slate .....                      | 0                                   | 3   |        |     |                      |
| Coal .....                       | 0                                   | 5   |        |     |                      |
| Bone coal.....                   | 0                                   | 2   |        |     |                      |
| Sandstone ....                   | 0                                   | 3   |        |     |                      |
| Bone .....                       | 0                                   | 2   |        |     |                      |
| Slate .....                      | 0                                   | 6   |        |     |                      |
| Coal .....                       | 0                                   | 3   |        |     |                      |
| Fire clay.....                   | 4                                   | 8   | 137    | 4   |                      |
| Sandstone.....                   | 8                                   | 0   | 145    | 4   |                      |
| Slate, dark.....                 | 6                                   | 6   | 151    | 10  |                      |
| Fire clay.....                   | 4                                   | 5   | 156    | 3   |                      |
| Limestone.....                   | 12                                  | 11  | 169    | 2   |                      |
| Fire clay.....                   | 5                                   | 4   | 174    | 6   |                      |
| Sandstone.....                   | 8                                   | 8   | 183    | 2   |                      |
| Slate, dark.....                 | 19                                  | 5   | 202    | 7   |                      |
| Sandstone.....                   | 17                                  | 3   | 219    | 10  |                      |
| Fire clay.....                   | 9                                   | 3   | 229    | 1   |                      |
| Shale, blue.....                 | 6                                   | 0   | 235    | 1   |                      |
| Sandstone, (Arnoldsburg).....    | 15                                  | 0   | 250    | 0   |                      |
| Fire clay.....                   | 12                                  | 0   | 262    | 1   |                      |
| Slate, gray.....                 | 16                                  | 0   | 278    | 1   |                      |
| Limestone.....                   | 1                                   | 8   | 279    | 9   |                      |
| Fire clay.....                   | 2                                   | 0   | 281    | 9   |                      |
| Limestone.....                   | 17                                  | 5   | 299    | 2   |                      |
| Fire clay.....                   | 7                                   | 5   | 306    | 7   |                      |
| Limestone.....                   | 6                                   | 0   | 312    | 7   |                      |
| Shale, blue.....                 | 9                                   | 0   | 321    | 7   |                      |
| Limestone.....                   | 9                                   | 0   | 330    | 7   |                      |
| Shale, blue.....                 | 6                                   | 0   | 336    | 7   |                      |
| Limestone.....                   | 7                                   | 0   | 343    | 7   |                      |
| Sandstone, gray (Sewickley)..... | 65                                  | 0   | 408    | 7   |                      |
| Slate.....                       | 0                                   | 1   | 408    | 8   |                      |
| Coal .....                       | 5'                                  | 8"  | 414    | 5   | Sewickley .....      |
| Coal and slate. 0 1              | (Elevation of base, 744.6' L-A. T.) |     |        |     |                      |
| Fire clay.....                   | 4                                   | 7   | 419    | 0   |                      |
| Limestone.....                   | 15                                  | 3   | 434    | 3   |                      |
| Fire clay.....                   | 4                                   | 0   | 438    | 3   |                      |
| Limestone.....                   | 4                                   | 0   | 442    | 3   |                      |
| Fire clay.....                   | 2                                   | 0   | 444    | 3   |                      |
| Limestone.....                   | 16                                  | 8   | 460    | 11  |                      |
| Fire clay.....                   | 2                                   | 5   | 463    | 4   |                      |

|                          | Thickness. |     | Total |     |
|--------------------------|------------|-----|-------|-----|
|                          | Ft.        | In. | Ft.   | In. |
| Coal, (Redstone).....    | 1          | 3   | 464   | 7   |
| Slate, dark.....         | 1          | 9   | 466   | 4   |
| Limestone.....           | 11         | 2   | 477   | 6   |
| Fire clay.....           | 2          | 3   | 479   | 9   |
| Sandstone.....           | 0          | 10  | 480   | 7   |
| Shale, sandy.....        | 3          | 4   | 483   | 11  |
| Slate and coal.....      | 2'         | 3"  |       |     |
| Coal.....                | 0          | 2   |       |     |
| Slate, black.....        | 1          | 4   |       |     |
| Coal.....                | 0          | 4   |       |     |
| Slate and fire clay..    | 0          | 6   |       |     |
| Coal.....                | 0          | 10  |       |     |
| Slate.....               | 0          | 1   |       |     |
| Coal.....                | 6          | 9   |       |     |
| Fire clay to bottom..... | 1          | 8   | 498   | 3   |

Pittsburgh ..... 12 8 496 7  
 (Elevation of base,  
 662.4' L-A. T.)

### Joseph E. Lynch Coal Test No. 5 (308).

Grant district, 1.8 miles north of Georgetown. Authority, Consolidation Coal Company.

|   | Thickness. |     | Total. |     |
|---|------------|-----|--------|-----|
|   | Ft.        | In. | Ft.    | In. |
| (Elevation, 1068.3' L-A. T.)                        |            |     |        |     |
| Surface, limestone, sandstone and shale.....        | 50         | 6   | 50     | 6   |
| Slate, dark, Uniontown coal.....                    | 6          | 0   | 56     | 6   |
| Shale and sandstone.....                            | 52         | 4   | 108    | 10  |
| Slate, black, Lower Uniontown coal.....             | 0          | 4   | 109    | 2   |
| Shale, limestones and sandstones.....               | 142        | 11  | 252    | 1   |
| Sandstone and slate in layers.....                  | 16         | 3   | 268    | 4   |
| Coal, Sewickley (Elevation of base, 794.4' L-A. T.) | 5          | 7   | 273    | 11  |
| Fire clay.....                                      | 4          | 0   | 277    | 11  |
| Slate, black.....                                   | 1          | 4   | 279    | 3   |
| Sandstone.....                                      | 12         | 5   | 291    | 8   |
| Fire clay.....                                      | 8          | 5   | 300    | 1   |
| Limestone.....                                      | 20         | 8   | 320    | 9   |
| Fire clay.....                                      | 3          | 6   | 324    | 3   |
| Coal, Redstone.....                                 | 1          | 8   | 325    | 11  |
| Slate and fire clay.....                            | 1          | 9   | 327    | 8   |
| Limestone.....                                      | 14         | 6   | 342    | 2   |
| Slate and fire clay.....                            | 10         | 9   | 352    | 11  |
| Coal.....   | 4'         | 7"  |        |     |
| Sulphur ball..                                      | 0          | 1   |        |     |
| Coal.....   | 3          | 4   |        |     |
| Sandy shale to bottom.....                          | 2          | 7   | 363    | 6   |

Pittsburgh ..... 8 0 360 11  
 (Elevation of base,  
 707.4' L-A. T.)

### A. C. Barker Coal Test No. 6 (314).

Grant district, 1.2 miles northeast of Georgetown. Authority, Consolidation Coal Company.

|                                   | Thickness. |     | Total. |     |
|-----------------------------------|------------|-----|--------|-----|
|                                   | Ft.        | In. | Ft.    | In. |
| (Elevation, 998.99' L-A. T.)      |            |     |        |     |
| Surface, limestone and shale..... | 169        | 2   | 169    | 2   |
| Sandstone, Sewickley.....         | 11         | 0   | 180    | 2   |
| Slate, dark.....                  | 3          | 5   | 183    | 7   |
| Coal.....                         | 0'         | 6"  |        |     |
| Binder ..                         | 0          | 1   |        |     |
| Coal.....                         | 5          | 10  |        |     |
| Upper Sewickley.....              | 6          | 5   | 190    | 0   |

(Elevation of base, 808.99' L-A. T.)

|                                       | Thickness.   |                                       | Total. |     |   |    |     |   |
|---------------------------------------|--------------|---------------------------------------|--------|-----|---|----|-----|---|
|                                       | Ft.          | In.                                   | Ft.    | In. |   |    |     |   |
| Dark slate .....                      | 5            | 4                                     | 195    | 4   |   |    |     |   |
| Limestone .....                       | 12           | 0                                     | 207    | 4   |   |    |     |   |
| Fire clay .....                       | 8            | 4                                     | 215    | 8   |   |    |     |   |
| Coal and slate, Lower Sewickley ..... | 0            | 5                                     | 216    | 1   |   |    |     |   |
| Limestone .....                       | 4            | 10                                    | 220    | 11  |   |    |     |   |
| Shale, light .....                    | 1            | 0                                     | 221    | 11  |   |    |     |   |
| Limestone .....                       | 7            | 3                                     | 229    | 2   |   |    |     |   |
| Fire clay and lime .....              | 9            | 0                                     | 238    | 2   |   |    |     |   |
| Fire clay .....                       | 6            | 7                                     | 244    | 9   |   |    |     |   |
| Coal, Redstone .....                  | 2            | 0                                     | 246    | 9   |   |    |     |   |
| Limestone .....                       | 17           | 0                                     | 263    | 9   |   |    |     |   |
| Slate and fire clay .....             | 5            | 2                                     | 268    | 11  |   |    |     |   |
| Coal .....0' 1"                       | } Pittsburgh | } (Elevation of base, 717.2' L-A. T.) | 12     | 11  |   |    |     |   |
| Slate, dark.....2 10                  |              |                                       |        |     |   |    |     |   |
| Coal .....1 0                         |              |                                       |        |     |   |    |     |   |
| Fire clay, soft..0 8                  |              |                                       |        |     |   |    |     |   |
| Coal .....2 2                         |              |                                       |        |     |   |    |     |   |
| Sulphur binder.0 1                    |              |                                       |        |     |   |    |     |   |
| Coal .....6 1                         |              |                                       |        |     |   |    |     |   |
| Fire clay and shale to bottom.....    |              |                                       |        |     | 1 | 11 | 283 | 9 |

**C. M. Arnett Coal Test No. 7 (313).**

Grant district, 0.3 mile northwest of Arnettville. Authority, Consolidation Coal Company.

|                                   | Thickness.   |                                       | Total. |     |
|-----------------------------------|--------------|---------------------------------------|--------|-----|
|                                   | Ft.          | In.                                   | Ft.    | In. |
| (Elevation, 950.7' L-A. T.)       |              |                                       |        |     |
| Surface, limestone and shale..... | 56           | 1                                     | 56     | 1   |
| Sandstone, Sewickley .....        | 58           | 9                                     | 114    | 10  |
| Coal, Upper Sewickley.....        | 4            | 11                                    | 119    | 9   |
| Fire clay and limestone.....      | 65           | 7                                     | 185    | 4   |
| Sandstone, Upper Pittsburgh.....  | 37           | 6                                     | 222    | 10  |
| Coal .....0' 8"                   | } Pittsburgh | } (Elevation of base, 718.5' L-A. T.) | 9      | 5   |
| Slate .....0 6                    |              |                                       |        |     |
| Coal .....8 3                     |              |                                       |        |     |
| Fire clay to bottom.....          | 1            | 4                                     | 233    | 7   |

**S. C. Stewart Coal Test No. 8 (309).**

Grant district, 1.8 miles northwest of Arnettville. Authority, Consolidation Coal Company.

|                              | Thickness.   |         | Total. |     |
|------------------------------|--------------|---------|--------|-----|
|                              | Ft.          | In.     | Ft.    | In. |
| (Elevation, 1082.8' L-A. T.) |              |         |        |     |
| Surface .....                | 2            | 9       | 2      | 9   |
| Sandstone, Waynesburg .....  | 27           | 0       | 29     | 9   |
| Slate, black .....           | 1            | 3       | 31     | 0   |
| Coal .....0' 8"              | } Waynesburg | } ..... | 7      | 0   |
| Fire clay .....0 11          |              |         |        |     |
| Slate .....1 0               |              |         |        |     |
| Coal .....1 10               |              |         |        |     |
| Slate .....0 11              |              |         |        |     |
| Coal .....1 8                |              |         |        |     |
| Fire clay .....              | 12           | 0       | 50     | 0   |
| Sandstone .....              | 8            | 0       | 58     | 0   |
| Slate .....                  | 12           | 0       | 70     | 0   |
| Limestone .....              | 15           | 0       | 85     | 0   |

|                               | Thickness. |     | Total. |     |
|-------------------------------|------------|-----|--------|-----|
|                               | Ft.        | In. | Ft.    | In. |
| Shale, blue .....             | 12         | 0   | 152    | 0   |
| Limestone .....               | 13         | 0   | 165    | 0   |
| Shale, red .....              | 6          | 0   | 171    | 0   |
| Sandstone .....               | 4          | 0   | 175    | 0   |
| Shale, green .....            | 10         | 0   | 185    | 0   |
| Limestone .....               | 30         | 0   | 215    | 0   |
| Green shale .....             | 20         | 0   | 235    | 0   |
| Limestone .....               | 24         | 0   | 259    | 0   |
| Sandstone, Sewickley .....    | 66         | 5   | 325    | 5   |
| Coal, Sewickley .....         | 3          | 3   | 328    | 8   |
| Fire clay .....               | 4          | 6   | 333    | 2   |
| Limestone and fire clay ..... | 61         | 8   | 394    | 10  |
| Slate and fire clay .....     | 6          | 0   | 400    | 10  |
| Coal and slate..... 4' 2"     |            |     |        |     |
| Black carbon slate.. 1 4      |            |     |        |     |
| Clay, soft .....              | 1          | 0   |        |     |
| Coal .....                    | 0          | 5   |        |     |
| Binder .....                  | 0          | 3   |        |     |
| Coal .....                    | 1          | 3   |        |     |
| Binder .....                  | 0          | 5   |        |     |
| Coal .....                    | 2          | 2½  |        |     |
| Binder .....                  | 0          | 1   |        |     |
| Coal .....                    | 4          | 0½  |        |     |
| Fire clay to bottom.....      | 1          | 8   | 417    | 8   |

Pittsburgh ..... 15 2 416 0  
 (Elevation of base,  
 666.8' L-A. T.)

### Martha A. Miller Coal Test No. 9 (234).

Clay district, at Hagans. Authority, Consolidation Coal Co.

|  | Thickness. |     | Total. |     |
|--|------------|-----|--------|-----|
|  | Ft.        | In. | Ft.    | In. |
| (Elevation, 1010.25' L-A. T.)                |            |     |        |     |
| Shale, blue .....                            | 10         | 0   | 95     | 0   |
| Sandstone .....                              | 9          | 0   | 104    | 0   |
| Slate and fire clay .....                    | 28         | 0   | 132    | 0   |
| Limestone .....                              | 8          | 0   | 140    | 0   |
| Surface, sandstone, limestone and shale..... | 68         | 1   | 68     | 1   |
| Coal and slate, Uniontown.....               | 0          | 2   | 68     | 3   |
| Limestone, sandstone and shale.....          | 173        | 3   | 246    | 6   |
| Slate, dark .....                            | 18         | 5   | 264    | 11  |
| Coal .....                                   | 5'         | 8"  |        |     |
| Binder .....                                 | 0          | 3   |        |     |
| Coal and sulphur. 0 9                        |            |     |        |     |
| Fire clay .....                              | 7          | 3   | 271    | 7   |
| Limestone .....                              | 12         | 9   | 278    | 10  |
| Fire clay .....                              | 12         | 8   | 291    | 7   |
| Limestone .....                              | 26         | 6   | 304    | 3   |
| Slate, black .....                           | 0          | 4   | 330    | 9   |
| Coal .....                                   | 2'         | 6"  |        |     |
| Slate .....                                  | 0          | 7   |        |     |
| Coal .....                                   | 0          | 2   |        |     |
| Slate, dark .....                            | 6          | 4   | 331    | 1   |
| Sandstone .....                              | 0          | 9   | 334    | 4   |
| Clay, soft .....                             | 0          | 3   | 340    | 8   |

Sewickley ..... 6 8 271 7  
 (Elevation of base,  
 738.6' L-A. T.)

Redstone ..... 3 3 334 4

|                                    | Thickness.   |     | Total. |     |   |
|------------------------------------|--|-----|--------|-----|---|
|                                    | Ft.  | In. | Ft.    | In. |   |
| Dark slate and coal..... 2' 0"     | } Lost core, which probably represents Pittsburgh coal cut out by clay vein..... |     |        |     |   |
| Fire clay..... 11 4                |  | 13  | 4      | 355 | 0 |
| Shale, gray.....                   |  | 2   | 0      | 357 | 0 |
| Sandstone.....                     |  | 26  | 5      | 383 | 5 |
| Shale, blue.....                   |  | 3   | 4      | 386 | 9 |
| Shale and fire clay to bottom..... |  | 10  | 7      | 397 | 4 |

Another test called No. 9' by the company was made on the same farm and at about the same elevation, the record of which is as follows:

**Martha A. Miller Coal Test No. 9' (234).**

|  | Thickness.   |     | Total. |     |    |
|--|--------------|-----|--------|-----|----|
|  | Ft.          | In. | Ft.    | In. |    |
| (Elevation, 1009.58' L-A. T.)                              |              |     |        |     |    |
| Surface, sandstone and fire clay.....                      | 22           | 3   | 22     | 3   |    |
| Coal, Uniontown.....                                       | 0            | 3   | 22     | 6   |    |
| Limestone, sandstone and slate.....                        | 41           | 11  | 64     | 5   |    |
| Slate and coal, Lower Uniontown.....                       | 0            | 2   | 64     | 7   |    |
| Sandstone, limestone and shale.....                        | 162          | 8   | 227    | 3   |    |
| Shale, dark, sandy.....                                    | 37           | 5   | 264    | 8   |    |
| Coal..... 5' 7"  | } Sewickley  |     |        |     |    |
| Binder..... 0 3  |              | 6   | 4      | 271 | 0  |
| Coal and slate.. 0 6                                       |              |     |        |     |    |
| Fire clay, limestone and fire clay.....                    | 57           | 10  | 328    | 10  |    |
| Coal..... 2' 10"   | } (Redstone) |     |        |     |    |
| Slate..... 1 0   |              | 4   | 1      | 332 | 11 |
| Coal, bony..... 0 3  |              |     |        |     |    |
| Slate, black.....  | 0            | 4   | 333    | 3   |    |
| Shale, sandy.....  | 5            | 5   | 338    | 8   |    |
| Fire clay.....   | 0            | 4   | 339    | 0   |    |
| Slate.....   | 0            | 6   | 339    | 6   |    |
| Sandstone, dark.....                                       | 0            | 4   | 339    | 10  |    |
| Coal, Pittsburgh (elevation of base, 663.92' L-A. T.)..... | 5            | 10  | 345    | 8   |    |
| Fire clay to bottom.....                                   | 1            | 11  | 347    | 7   |    |

**Mary J. Lynch Coal Test No. 10 (311).**

Grant district, 1.8 miles northwest of Arnettville. Authority, Consolidation Coal Company.

|  | Thickness. |     | Total. |     |
|--|------------|-----|--------|-----|
|  | Ft.        | In. | Ft.    | In. |
| Surface, sandstone, shale and limestone..... | 125        | 3   | 125    | 3   |
| Sandstone, Sewickley.....                    | 44         | 4   | 169    | 7   |
| Shale, dark.....                             | 4          | 1   | 173    | 8   |
| Sandstone.....                               | 3          | 2   | 176    | 10  |
| Slate, dark.....                             | 2          | 2   | 179    | 0   |



|                                    |            | Thickness.                           |      | Total. |     |
|------------------------------------|------------|--------------------------------------|------|--------|-----|
|                                    |            | Ft.                                  | In.  | Ft.    | In. |
| Coal                               | .....3' 0" | } Upper Sewickley.....               | 7 10 | 186    | 10  |
| Binder                             | .....0 1   |                                      |      |        |     |
| Coal                               | .....1 11  |                                      |      |        |     |
| Binder                             | .....0 1   |                                      |      |        |     |
| Sulphur and coal                   | ..0 11     |                                      |      |        |     |
| Fire clay, shaly                   | ..0 11     |                                      |      |        |     |
| Coal                               | .....0 11  |                                      |      |        |     |
| Fire clay, limestone and fire clay | .....      | 49                                   | 5    | 236    | 3   |
| Coal, Redstone                     | .....      | 1                                    | 0    | 237    | 3   |
| Fire clay                          | .....      | 21                                   | 9    | 259    | 0   |
| Slate, dark                        | .....      | 2                                    | 10   | 261    | 10  |
| Coal                               | .....0' 4" | } Pittsburgh                         | 7 11 | 269    | 9   |
| Slate                              | ....0 10   |                                      |      |        |     |
| Coal                               | ....6 9    |                                      |      |        |     |
| Fire clay to bottom                | .....      |                                      |      |        |     |
|                                    |            | (Elevation of base, 709.92' L.A. T.) |      |        |     |
|                                    |            | 2                                    | 5    | 272    | 2   |

### *The Waynesburg Coal.*

The Waynesburg coal, described in detail in Chapter VI., will prove to be a valuable resource. As shown by the Table of Coal Analyses, its sulphur content is but little higher than in considerable areas of the Pittsburgh coal, some of the mines being low enough in this impurity to make them available for coke manufacture. The principal objection to the coal is the large parting of shale usually found near the center of the seam. Owing to the fine thickness of the coal, often reaching 10 feet, it is possible to dispose of this shale by "gobbing" it within the mine, thus saving the expense of hauling it out. The value of the Waynesburg coal has been underestimated because of the great amount of Pittsburgh coal available in the same region. Its outcrop is shown in detail on Map II.

### **Quantity of Waynesburg Coal Available.**

In western Monongalia and Marion counties, where the Waynesburg coal lies under drainage, its thickness has been noted in numerous oil well records. These records are sufficiently well distributed, as the following table will show, to authorize the statement that the Waynesburg coal is of minable thickness at all points within this district west of its outcrop.

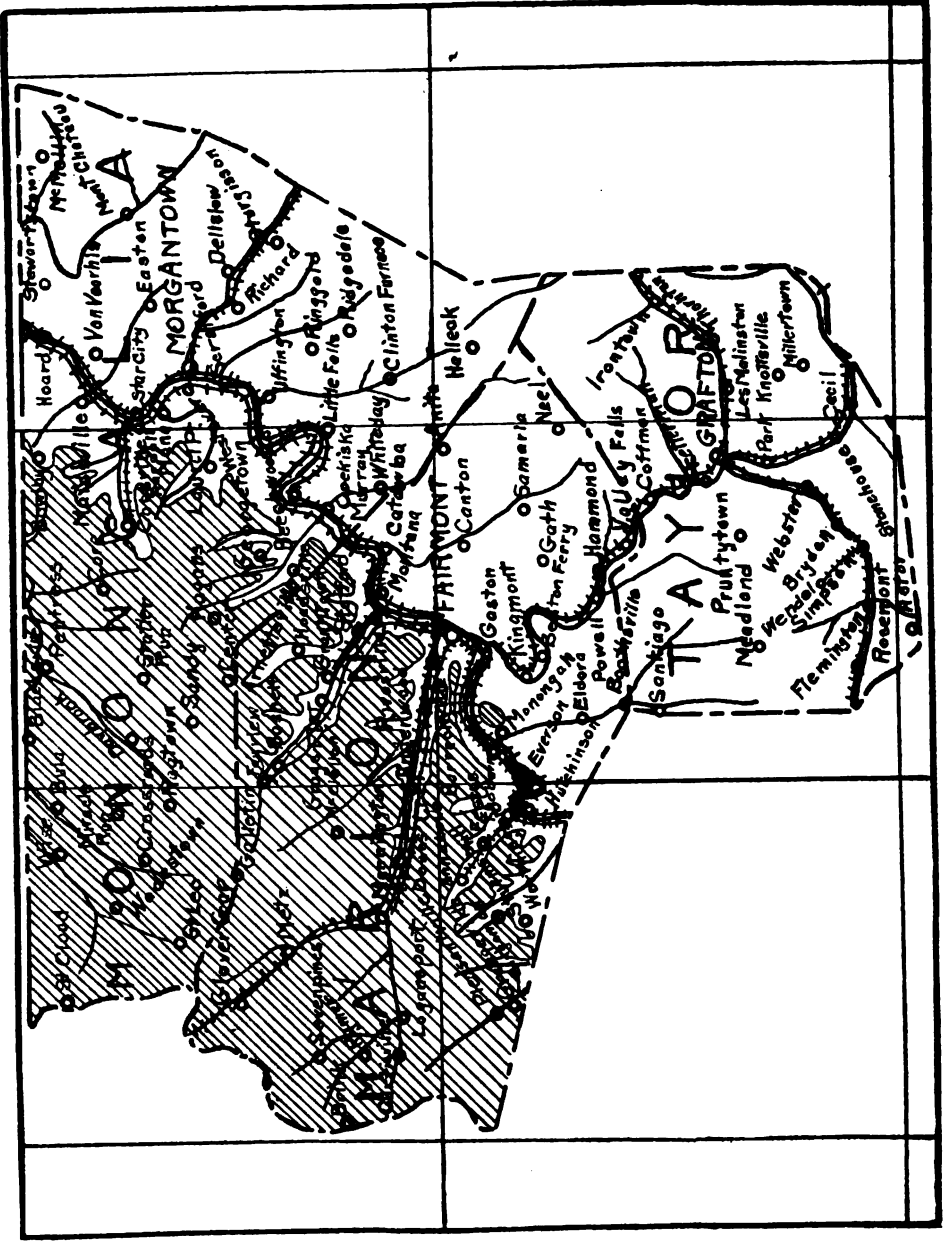


Figure 5.—Showing area of Wayneburg Coal.

## List of Wells Recording Waynesburg Coal.

| No. on Map. | NAME OF WELL.                          | LOCATION.                      | Elevation of Well Mouth. A. T. | Depth Feet. | Thickness Feet. |
|-------------|--|--------------------------------|--------------------------------|-------------|-----------------|
|             | <b>Monongalia County</b>               |                                |                                |             |                 |
| 3           | Kinzey Renner Hrs. No. 1.....          | Garrison, 1.1 m. SW. ....      | 1115B                          | 590         | 4               |
| 5           | Eli White No. 1.....                   | St. Cloud, 1.6 m. NE .....     | 1075B                          | 500         | 5               |
| 8           | John G. White No. 1.                   | Maple, 0.7 m. W.               | 1150B                          | 780         | 5               |
| 10          | Thos. White No. 1..                    | Maple, 0.4 m. NE               | 1065B                          | 450         | 6               |
| 12          | J. P. Hagan No. 2..                    | Hero, 0.9 m. W.                | 1095B                          | 480         | 3               |
| 20          | T. W. Kinnan No. 1..                   | Jollytown, 1 m. SE .....       | 1060B                          | 440         | ..              |
| 35          | Elijah C. Clovis No. 1                 | St. Cloud, 1.1 m. E. ....      | 1165B                          | 585         | 3               |
| 38          | Nancy Hostutler No. 1.....             | St. Cloud, 0.7 m. SE. ....     | 1200B                          | 645         | 5               |
| 47          | Jacob (B. F.) Lim- ing No. 1.....      | Cottontown, 1.3 m. E.....      | 1370B                          | 849         | 2               |
| 53          | John Estel Hrs. No. 1                  | St. Leo, 1 m. N 15° E.....     | ....                           | 945         | 4               |
| 80          | M. J. Garrison No. 1.                  | Wadestown, 1.2 m. SE.....      | 1120B                          | 524         | 5               |
| 82          | M. J. & J. L. Garri- son No. 1831..... | Wadestown, 1.1 m. S 10° E..    | ....                           | 680         | ..              |
| 90          | Sam'l Eakin No. 1...                   | St. Leo, 1.8 m. E.             | 1125B                          | 560         | 4               |
| 93          | M. J. (Crocker) Gar- rison No. 1.....  | Wadestown, 1.4 m. S.....       | 1075B                          | 525         | 5               |
| 96          | Wilson Haught No. 4                    | St. Leo, 0.9 m. NE. ....       | ....                           | 887         | ..              |
| 117         | Corbra Anderson No. 2.....             | Ragtown, 1.3 m. SW. ....       | 1617L                          | 955         | 5               |
| 147         | Sol Meyers No. 1...                    | Blacksville, 1.2 m. S.....     | 1104L                          | 400         | ..              |
| 148         | Sol Meyers No. 1...                    | Blacksville, 1.3 m. S 10° W... | 1110B                          | 400         | ..              |
| 149         | Reason Sine No. 1..                    | Blacksville, 1.5 m. S.....     | 1239L                          | 540         | 0               |
| 152         | Asa Lemley No. 2..                     | Blacksville, 2.1 m. S.....     | 1195B                          | 480         | 7               |
| 153         | James Lemley Hrs. No. 1.....           | Daybrook, 1.6 m. NW. ....      | 1225B                          | 515         | ..              |
| 168         | Grant Stephens.....                    | Mooreville .....               | 960B                           | 105         | 2.5             |
| 171         | Etta Core No. 2268..                   | Worley, 0.5 m. SW. ....        | 1345B                          | 485         | 5               |
| 172         | Lee R. Shriver No. 2.                  | Worley, 0.6 m. NE. ....        | 965B                           | 195         | ..              |
| 176         | Lee R. Shriver No. 1.                  | Worley, 0.8 m. NE. ....        | 925B                           | 195         | ..              |
| 211         | D. J. Eddy.....                        | Behler, 0.5 m. S.              | 1058L                          | 126         | 7.6             |
| 217         | M. C. Wildman No. 1123 .....           | Pedlar, 0.2 m. NE              | 1130B                          | 316         | 5               |
| 230         | Martha A. Miller No. 1.....            | Hagans, 2.2 m. NE. ....        | 1225B                          | 216         | 6               |
| 232         | Cal Hawkins No. 1..                    | Hagans, 0.5 m. E               | ....                           | 210         | 6               |
| 250         | Bowen Wade No. 2..                     | Bowlby, 0.9 m. N 20° E.....    | 1190B                          | 55          | 9               |

| No. on Map.           | NAME OF WELL.                   | LOCATION.                  | Elevation of Well Mouth. A. T. | Depth Feet. | Thickness Feet. |
|-----------------------|---------------------------------|----------------------------|--------------------------------|-------------|-----------------|
| 254                   | Spencer Cunningham No. 1.       | Bowlby, 1.2 m. W.          | 1195B                          | 145         | 5               |
| 255                   | Iona Bowlby No. 4.              | Bowlby, 0.6 m. S 80° W.    | 1220B                          | 99          | 6               |
| 256                   | H. C. Bowlby No. 5.             | Bowlby, 1.0 m. SW.         | ....                           | 352         | 8               |
| 257                   | E. Brand No. 2.                 | Bowlby, 1.2 m. SW.         | ....                           | 147         | 6               |
| 259                   | Wm. McCormick No. 2.            | Bowlby, 1.5 m. SW.         | 1245B                          | 100         | 8               |
| 260                   | Frank McCormick No. 1.          | Bowlby, 1.4 m. SW.         | 1215B                          | 65          | 5               |
| 262                   | Mark Weaver No. 1.              | Bowlby, 1.9 m. SW.         | 1130B                          | 100         | 8               |
| 269                   | David Henderson No. 1.          | Cassville, 1.3 m. S 75° W. | 1340B                          | 307         | 5               |
| 291                   | L. S. Bircher No. 1.            | Cassville, 1.4 m. SE.      | 1335B                          | 170         | 6               |
| 294                   | J. C. Brand No. 2.              | Cassville, 2 m. SW.        | ....                           | 320         | 7               |
| 295                   | Eugene Snyder No. 1.            | Hagans, 2.3 m. NE.         | ....                           | 60          | 5               |
| 298                   | Martha A. Miller No. 2.         | Hagans, 2.1 m. NE.         | 1255B                          | 240         | ..              |
| 300                   | J. N. Michael No. 1998          | Hagans, 1.8 m. NE.         | 1305B                          | 315         | 4               |
| 303                   | J. N. Michael coal test No. 2.  | Hagans, 1.8 m. NE.         | 1159L                          | 124         | 8.2             |
| 309                   | S. C. Stewart coal test No. 8.  | Arnettsville, 1.8 m. NW.   | 1083L                          | 31          | 7               |
| <b>Marion County:</b> |                                 |                            |                                |             |                 |
| 354                   | A. M. Glover No. 4.             | Glover Gap, 0.6 m. NW.     | 1160B                          | 600         | 3               |
| 355                   | A. M. Glover No. 3.             | Glover Gap, 0.6 m. NW.     | 1070B                          | 508         | 4               |
| 372                   | Riley Arnett No. 1.             | Rymer, 1.1 m. W.           | 1055B                          | 500         | 5               |
| 469                   | Alexander Huey No. 1.           | Curtisville, 1.3 m. S.     | ....                           | 442         | 11              |
| 497                   | Geo. Furbee No. 1.              | Mannington, 0.5 m. NW.     | 963B                           | 60          | 4               |
| 536                   | Lindsay Blaker No. 1.           | Pleasantville, 0.7 m. NE.  | 1115B                          | 155         | 3               |
| 555                   | Brice Wallace No. 1.            | Fairview, 1 m. NE.         | 1025B                          | 137         | 7               |
| 556                   | David Jones No. 5.              | Fairview, 0.9 m. N 10° W.  | ....                           | 320         | 4               |
| 591                   | Wm. Wallace No. 1.              | Fairview, 2.1 m. SW.       | 1110B                          | 197         | 2               |
| 599                   | Rezin Amos No. 1.               | Downs, 1.3 m. N.           | 1117L                          | 110         | 4               |
| 634A                  | Absalom Martin core test No. 1. | Festus, 2 m. NW.           | 1122L                          | 29          | 6               |

With the data contained in the foregoing table and with the thickness shown at many openings described in Chapter VI an average thickness of 3.5 feet is conservative and with areas determined by planimeter from Map II the following tonnage estimate has been made by Reger of the Waynesburg coal:

#### Available Waynesburg Coal.

| Counties by Districts.       | Square Miles. | Acres.         | Cubic Feet of Coal    | Short Tons of Coal   |
|------------------------------|---------------|----------------|-----------------------|----------------------|
| <b>Monongalia:</b>           |               |                |                       |                      |
| Battelle .....               | 56.40         | 36,096         | 5,403,196,160         | 216,127,846          |
| Clay .....                   | 63.43         | 40,595         | 6,199,113,700         | 247,964,548          |
| Cass .....                   | 16.69         | 10,682         | 1,628,576,720         | 65,143,069           |
| Grant .....                  | 17.69         | 11,322         | 1,726,152,120         | 69,046,085           |
| <b>Totals .....</b>          | <b>154.21</b> | <b>98,695</b>  | <b>14,957,038,700</b> | <b>598,281,548</b>   |
| <b>Marion:</b>               |               |                |                       |                      |
| Mannington .....             | 98.30         | 62,912         | 9,591,562,520         | 383,662,501          |
| Pawpaw .....                 | 29.60         | 18,944         | 2,888,202,240         | 115,528,090          |
| Lincoln .....                | 42.44         | 27,162         | 4,141,118,520         | 165,644,741          |
| Fairmont .....               | 9.35          | 5,984          | 912,320,640           | 36,492,826           |
| Grant .....                  | 0.52          | 333            | 50,769,180            | 2,030,767            |
| <b>Totals .....</b>          | <b>180.21</b> | <b>115,335</b> | <b>17,583,973,100</b> | <b>703,358,925</b>   |
| <b>Totals for Area .....</b> | <b>334.42</b> | <b>214,030</b> | <b>32,541,011,800</b> | <b>1,301,640,473</b> |

#### The Sewickley Coal.

The Sewickley coal, described briefly in Chapter VI, is another coal that has been greatly overshadowed by the Pittsburgh. In the western districts of Monongalia and Marion counties where it lies far under drainage, few records of any sort are available to determine its chemical character. The only exception is the sample obtained from the T. W. Kinnan gas well in Battelle district, saved by the driller and published in the Table of Coal Analyses. In central Monongalia and Marion, however, numerous tests have been made to show that the coal is one to two per cent higher in sulphur than the Pittsburgh coal, slightly higher in ash, and but little inferior in British thermal units. The high sulphur content makes it objectionable for coke manufacture, but it is an excellent coal for steam or heating purposes. In the territory of this report it is mined commercially at only one place, near Rivesville. Marion county, where the following information was obtained.





PLATE XXVIII.—Topography of the Monongahela Series and Mine of the Parker Run Coal & Coke Company (No. 15 on Map II) in the Sewickley coal, showing combination railroad and river tipple, at Rivesville, Marlon County. Photo by Ray Bricker.

**Parker Run Coal & Coke Co., Parker Run Mine.—No. 15  
on Map II.**

Located  $\frac{1}{2}$  mile east of Rivesville; Sewickley coal.

|                           | Ft.   | In.                     |
|---------------------------|---|-------------------------|
| 1. Shale, gray.....       |   |                         |
| 2. Coal, good.....        | 3'  | 8 "                     |
| 3. Bone .....             | 0   | 0 $\frac{3}{4}$         |
| 4. Coal, good.....        | 2   | 3                       |
| 5. Shale, gray, hard..... | 0   | 1                       |
| 6. Coal, hard.....        | 0   | 9                       |
|                           | <hr style="width: 100px; margin: 0 auto;"/> | ..... 6 9 $\frac{3}{4}$ |
| 7. Fire clay.....         |   |                         |

"Tidal elevation, 907' spirit level; principal office, Rivesville; daily capacity, 500 tons; 10 laborers and 25 miners employed; horse haulage; used for steam and domestic fuel; shipped north, east and west; butts, N 78° W; faces, N 12° E; greatest rise, S 60° E; sample collected for analysis from Nos. 2 and 4 of section in Room No. 27 of Second Right Heading by D. B. Reger; C. Kelley, Superintendent, authority for data."

An analysis of this coal was published in Bulletin II of the Survey Reports under table 17, opposite page 312, which shows a somewhat higher thermal unit result than the one obtained at the section above.

**Dakota Coal & Coke Co.—No. 15(A) on Map II.**

Located at Dakota; Sewickley coal.

This mine does not at present operate the Sewickley coal but it was sampled by the Survey a few years ago.

In addition to the information obtained in the Table of Coal Analyses in this report, numerous other tests have been made of the Sewickley coal which are assembled in the following table.

**Table of Sewickley Coal Analyses.**

| Analysis No. | Mois. | V.M.  | F.C.  | Ash.  | Sul. | Phos.  | B.T.U. |
|--------------|-------|-------|-------|-------|------|--------|--------|
| 1            | 1.03  | 35.33 | 53.93 | 9.21  | 2.72 | 0.011  | 13355  |
| 2            | 1.64  | 34.55 | 51.87 | 11.94 | 3.59 | 0.010  | 12859  |
| 3            | 1.23  | 33.23 | 54.67 | 10.87 | 1.45 | 0.008  | 13417  |
| 4            | 0.64  | 34.57 | 54.22 | 10.57 | 2.88 | 0.005  | 12983  |
| 5            | 1.25  | 38.47 | 51.57 | 8.71  | 4.62 | 0.0057 | 13231  |
| 6            | 1.13  | 37.29 | 49.26 | 12.32 | 4.91 | 0.006  | 12726  |
| 7            | 1.03  | 39.90 | 47.19 | 11.88 | 4.80 | .....  | .....  |
| 8            | 1.40  | 38.15 | 49.87 | 10.58 | 3.47 | .....  | .....  |
| 9            | 0.75  | 34.17 | 52.24 | 12.84 | 2.82 | 0.015  | 12642  |
| 10           | 1.42  | 37.37 | 51.79 | 9.42  | 4.33 | .....  | .....  |
| 11           | 1.14  | 36.62 | 50.90 | 11.34 | 4.52 | .....  | .....  |
| 12           | 1.26  | 37.24 | 52.14 | 9.36  | 4.60 | .....  | .....  |



| Analysis No. | Mois. | V.M.  | F.C.  | Ash.  | Sul. | Phos. | B.T.U. |
|--------------|-------|-------|-------|-------|------|-------|--------|
| 13           | 1.36  | 36.40 | 47.70 | 14.54 | 5.34 | ..... | .....  |
| 14           | 1.30  | 36.70 | 51.16 | 9.84  | 4.10 | ..... | .....  |
| 15           | 1.60  | 35.20 | 51.04 | 12.16 | 3.08 | ..... | .....  |
| 16           | 1.54  | 39.00 | 48.06 | 11.40 | 4.84 | ..... | .....  |
| 17           | 1.36  | 39.08 | 48.32 | 11.24 | 4.96 | ..... | .....  |
| 18           | 1.30  | 34.06 | 52.44 | 12.30 | 3.19 | ..... | .....  |
| 19           | 1.38  | 36.14 | 46.12 | 16.36 | 5.04 | ..... | .....  |
| 20           | 1.54  | 39.00 | 48.06 | 11.40 | 4.84 | ..... | .....  |
| Average ..   | 1.26  | 36.65 | 50.63 | 11.41 | 4.00 | 0.009 | 13030  |

Note.—Analyses Nos. 1-9 inclusive are taken from Vol. II(A), W. Va. Geol. Survey. All B.T.U. determinations should be 500 to 800 points higher owing to calorimeter being out of adjustment. Nos. 10-19 inclusive are by chemical department of Consolidation Coal Company, courtesy of Frank Haas; No. 20 by Pittsburgh-Buffalo Company.

#### Location of Samples in Sewickley Coal Analyses.

1. Wm. Baremore mine, on Scotts run, Monongalia county.
2. Wm. Deets mine, on Scotts run, Monongalia county.
3. C. C. Lazzell mine, on Robinson's run, Monongalia county.
4. J. A. Cox mine, on Indian creek, Monongalia county.
5. Millard Boggess mine, six-tenths mile above mouth of Mill Fall run, Marion county.
6. Chas. Jackson mine, on Tevebaugh creek, Marion county.
7. Mine on Tevebaugh creek, one mile from West Fork river, Marion county.
8. D. T. Martin mine, near Sturms Mill, on Little Bingamon creek, Marion county.
9. Jamison Coal & Coke Company No. 8 mine, 0.5 mile east of Underwood, Marion county.
10. W. P. Fortney coal test No. 3 (647), on Tevebaugh creek, Marion county.
11. Z. F. Davis coal test No. 4 (646), on Helens run, Marion county.
12. Nancy Martin coal test No. 6 (659), on Mill Fall run, Marion county.
13. Shore coal test No. 7 (672), on Ice's run, Marion county.
14. Morgan-Billingslee coal test No. 8 (669), on Buffalo creek, Marion county.
15. Curtis Fletcher coal test No. 9 (655), on Buffalo creek, Marion county.
16. W. S. Parish coal test No. 11 (638) on Tevebaugh creek, Marion county.
17. E. C. Morgan coal test No. 1 (663) on Helens run, Marion county.
18. Morgan-Fox coal test No. 14 (621), 0.5 mile north of Farmington, Marion county.
19. Nancy Billingsley coal test No. 5 (652), 0.5 mile northwest of Hutchinson, Marion county.
20. Absalom Martin coal test No. 1 (634A), 1.2 miles north of Annabelle, Marion county.

Attention is here called to the fact that the samples of Sewickley coal, taken in the mines of the Parker Run Coal & Coke Company (No. 15 on Map II) and the Dakota Coal & Coke Company (No. 15A on Map II) and published in the Table of Coal Analyses at the end of this chapter, show a better average analysis than those of the foregoing table. Since this is due to more favorable conditions for sampling, the two mines referred to probably represent the coal better than the miscellaneous list.

In the Summer of 1913 a core test was drilled in the southwest corner of Monongalia county that penetrates the Sewickley coal as well as several coals of the Dunkard series above. Owing to an accident by which the drilling tools were lost in the hole the Pittsburgh coal was not reached by about 40 feet. The well starts 56 feet, by hand-level measurement, below the Nineveh sandstone and must therefore start about 50 feet below the Nineveh coal which was not visible at any point in the immediate vicinity of the well, but may be seen in the public road 0.4 westward where it is 6 inches thick. The well record was furnished the Survey through the courtesy of J. V. Thompson of Uniontown, Pa., at the request of John W. Boileau, the eminent coal expert of Pittsburgh, Pa., and reads as follows:

### Eli Delaney Core Test (100A).

Battelle district, 1 mile southwest of St. Leo. Authority, S. J. Harry Diamond Core Drilling Company of Connellsville, Pa.

|                            | Thickness. |     | Total. |     |
|----------------------------|------------|-----|--------|-----|
|                            | Ft.        | In. | Ft.    | In. |
| Surface .....              | 20         | 0   | 20     | 0   |
| Green shale.....           | 20         | 6   | 40     | 6   |
| Red shale .....            | 9          | 2   | 49     | 8   |
| Sand shale .....           | 7          | 2   | 56     | 10  |
| Green shale .....          | 14         | 0   | 70     | 10  |
| Red shale.....             | 8          |     | 71     | 6   |
| Green shale.....           | 6          |     | 72     | 0   |
| Red shale .....            | 6          |     | 72     | 6   |
| Green shale .....          | 20         | 6   | 93     | 0   |
| Red shale .....            | 7          | 0   | 100    | 0   |
| Sand shale .....           | 10         | 0   | 110    | 0   |
| Green shale .....          | 25         | 0   | 135    | 0   |
| Sand shale .....           | 48         | 0   | 183    | 0   |
| Slate .....                | 10         | 0   | 193    | 0   |
| Sandstone, (Rush Run)..... | 10         | 0   | 203    | 0   |
| Limestone .....            | 3          | 0   | 206    | 0   |
| Green shale .....          | 10         | 6   | 216    | 6   |

|                                   | Thickness. |     | Total. |     |
|-----------------------------------|------------|-----|--------|-----|
|                                   | Ft.        | In. | Ft.    | In. |
| Red shale .....                   | 1          | 2   | 217    | 8   |
| Green shale .....                 | 5          | 6   | 223    | 2   |
| Red shale .....                   | 1          | 3   | 224    | 5   |
| Green shale .....                 | 18         | 0   | 242    | 5   |
| Sand shale .....                  | 2          | 2   | 244    | 7   |
| Green shale .....                 | 3          | 0   | 247    | 7   |
| Red shale .....                   | 0          | 10  | 248    | 5   |
| Green shale .....                 | 27         | 0   | 275    | 5   |
| Sandstone .....                   | 5          | 2   | 280    | 7   |
| Green shale .....                 | 30         | 0   | 310    | 7   |
| Sandstone, (Upper Marietta) ..... | 21         | 2   | 331    | 9   |
| Green shale .....                 | 4          | 0   | 335    | 9   |
| Sand shale .....                  | 2          | 6   | 338    | 3   |
| Green shale .....                 | 5          | 0   | 343    | 3   |
| Limetstone .....                  | 1          | 9   | 345    | 0   |
| Lime shale .....                  | 2          | 0   | 347    | 0   |
| Sandstone .....                   | 7          | 9   | 354    | 9   |
| Lime shale .....                  | 8          | 5   | 363    | 2   |
| Red shale .....                   | 1          | 6   | 364    | 8   |
| Lime shale .....                  | 20         | 0   | 384    | 8   |
| Red shale .....                   | 2          | 0   | 386    | 8   |
| Lime shale .....                  | 24         | 0   | 410    | 8   |
| Sand shale .....                  | 32         | 0   | 442    | 8   |
| Slate .....                       | 5          | 9   | 448    | 5   |
| Coal, (Washington) .....          | 0          | 4   | 448    | 9   |
| Slate .....                       | 0          | 5   | 449    | 2   |
| Sand .....                        | 9          | 6   | 458    | 8   |
| Slate .....                       | 6          | 0   | 464    | 8   |
| Lime shale .....                  | 5          | 3   | 469    | 11  |
| Sand slate .....                  | 6          | 6   | 476    | 5   |
| Coal, (Little Washington) .....   | 0          | 4   | 476    | 9   |
| Green shale .....                 | 22         | 0   | 498    | 9   |
| Sand shale .....                  | 47         | 2   | 545    | 11  |
| Slate .....                       | 1          | 3   | 547    | 2   |
| Coal, (Waynesburg "A") .....      | 2          | 0   | 549    | 2   |
| Slate .....                       | 0          | 9   | 549    | 11  |
| Lime shale .....                  | 11         | 10  | 561    | 9   |
| Sand shale .....                  | 41         | 3   | 603    | 0   |
| Slate .....                       | 2          | 8   | 605    | 8   |
| Coal, (Waynesburg) .....          | 2          | 4   | 608    | 0   |
| Sandstone .....                   | 2          | 0   | 610    | 0   |
| Sand shale .....                  | 51         | 0   | 661    | 0   |
| Green shale .....                 | 8          | 9   | 669    | 9   |
| Sandstone, (Uniontown) .....      | 50         | 3   | 720    | 0   |
| Lime shale .....                  | 27         | 0   | 747    | 0   |
| Green shale .....                 | 11         | 0   | 758    | 0   |
| Red shale .....                   | 3          | 0   | 761    | 0   |
| Lime and shale .....              | 10         | 0   | 771    | 0   |
| Limestone .....                   | 2          | 6   | 773    | 6   |
| Lime shale .....                  | 2          | 6   | 776    | 0   |
| Limestone .....                   | 15         | 0   | 791    | 0   |
| Lime shale .....                  | 6          | 8   | 797    | 8   |
| Red shale .....                   | 1          | 4   | 799    | 0   |
| Limestone, (Benwood) .....        | 68         | 0   | 867    | 0   |
| Slate .....                       | 2          | 6   | 869    | 6   |
| Coal, (Sewickley) .....           | 5          | 0   | 874    | 6   |
| Fire clay .....                   | 2          | 6   | 877    | 0   |

|                  | Thickness. |     | Total                 |     |   |     |   |
|------------------|------------|-----|-----------------------|-----|---|-----|---|
|                  | Ft.        | In. | Ft.                   | In. |   |     |   |
| Limestone .....  | 4'         | 0"  | Sewickley limestone.. | 12  | 6 | 889 | 6 |
| Lime shale ..... | 2          | 0   |                       |     |   |     |   |
| Limestone .....  | 6          | 6   |                       |     |   |     |   |
| Sand shale ..... | 1          | 7   |                       |     |   | 891 | 1 |
| Sandstone .....  | 4          | 5   |                       |     |   | 895 | 6 |
| Lime shale ..... | 10         | 6   |                       |     |   | 906 | 0 |
| Limestone .....  | 27         | 0   |                       |     |   | 933 | 0 |

The B. & O. Railroad, under the direction of C. McC. Lemley, has recently (1911) made extensive investigations of the Sewickley coal in Monongalia county. The following farms, mines and prospects were sampled by employees of the railroad and the samples analyzed in the laboratory of the Survey by Mr. Krak. For convenience the analyses are grouped on a subsequent page.

### Harvey Fisher Mine.

Located opposite Round Bottom; Sewickley coal.

|                                | Feet. | Inches. |
|--------------------------------|-------|---------|
| 0. Sandstone roof, about ..... | 25    | 0       |
| 1. Slate .....                 | 0     | 3       |
| 2. Coal .....                  | 1' 6" |         |
| 3. Slate, bone. 0'0½" to...0   | 0 ¼   |         |
| 4. Coal .....                  | 1     | 7       |
| 5. Bone 0' 0½" to .....        | 0     | 0 ¼     |
| 6. Coal .....                  | 1     | 4       |
| 7. Clay, 0'2" to .....         | 0     | 0       |
| 8. Coal .....                  | 1     | 5       |
| 9. Fire clay .....             | 0     | 3       |
| 10. Coal .....                 | 0     | 2       |
| 11. Fire clay .....            | 0     | 2       |
| 12. Coal .....                 | 0     | 6       |
|                                |       | 11½     |

13. Fire clay.  
 "Tidal elevation, 1230', aneroid; sample taken from Nos. 2-8 on outcrop, no entry made, just faced, by J. C. Hellig and R. C. Tucker."  
 Sample published under B. & O. Railroad Table.

### Markley Mine.

Located on Indian creek, 1 mile from Opekiska; Sewickley coal.

|                               | Feet. | Inches. |
|-------------------------------|-------|---------|
| 1. Sandstone-slate roof ..... |       |         |
| 2. Coal .....                 | 0' 6" |         |
| 3. Slate .....                | 0     | 0 ¼     |
| 4. Coal .....                 | 0     | 10      |
| 5. Parting .....              | 0     | 0 ¼     |
| 6. Coal .....                 | 1     | 4       |
| 7. Bone coal .....            | 0     | 1       |
| 8. Coal .....                 | 1     | 7       |
| 9. Parting .....              | 0     | 0 ¼     |

|                       |        |    | Feet. | Inches. |
|-----------------------|--------|----|-------|---------|
| 10. Coal              | .....0 | 8  |       |         |
| 11. Fire clay parting | .....0 | 0½ |       |         |
| 12. Coal              | .....0 | 2  | 5     | 3¼      |

## 13. Slate.

"Tidal elevation, 960', aneroid; butts, N 69° W; faces, N 21° E; sample collected from Nos. 2, 4, 6, 8, 10 and 12, by J. C. Heilig and R. C. Tucker." Sample published under B. & O. Railroad Table.

## David McLaughlin Mine.

Located at Laurel Point; Sewickley coal.

|                              |         |      | Feet. | Inches. |
|------------------------------|---------|------|-------|---------|
| 1. Sandstone roof            | .....   |      |       |         |
| 2. Coal                      | .....0' | 11 " |       |         |
| 3. Clay parting              | .....0  | 0½   |       |         |
| 4. Coal                      | .....0  | 8    |       |         |
| 5. Clay parting, 0" to       | .....0  | 1    |       |         |
| 6. Coal                      | .....0  | 4    |       |         |
| 7. Bone                      | .....0  | 0½   |       |         |
| 8. Coal                      | .....0  | 5    |       |         |
| 9. Clay                      | .....0  | 0½   |       |         |
| 10. Coal, streaked with bone | ...1    | 3    |       |         |
| 11. Slate                    | .....0  | 0¼   |       |         |
| 12. Coal                     | .....0  | 1    |       |         |
| 13. Slate                    | .....0  | 0½   |       |         |
| 14. Coal                     | .....0  | 2    |       |         |
| 15. Slate                    | .....0  | 0½   |       |         |
| 16. Coal                     | .....0  | 4    |       |         |
| 17. Slate                    | .....0  | 0¼   |       |         |
| 18. Coal                     | .....0  | 3    |       |         |
| 19. Slate                    | .....0  | 0¼   |       |         |
| 20. Coal                     | .....0  | 2    |       |         |
| 21. Slate                    | .....0  | 0¼   |       |         |
| 22. Coal (appears clean)     | .....1  | 4    | 6     | 2¾      |

## 23. Slate bottom.

"Tidal elevation, 1040', aneroid; butts, N 71° W; faces N 19° E; sample collected from all numbers containing coal, 150' in mine at last working face, by J. C. Heilig and R. C. Tucker." Sample published in B. & O. Railroad Table.

## B. &amp; O. Railroad Table of Analyses—Sewickley Coal.

Chemical Work by J. B. Krak.

| Mine.                    | Mois. | V. M. | F. C. | Ash. | Sul. | Phos.  |
|--------------------------|-------|-------|-------|------|------|--------|
| Harvey Fisher (prospect) | 4.31  | 33.54 | 55.00 | 7.15 | 1.84 | 0.003  |
| Markley                  | 1.61  | 36.72 | 54.30 | 7.37 | 2.65 | 0.0003 |
| David McLaughlin         | 1.08  | 36.98 | 52.21 | 9.73 | 4.30 | 0.0003 |
| Average                  | 2.33  | 35.75 | 53.84 | 8.08 | 2.93 | 0.0018 |



### Quantity of Sewickley Coal Available.

Since the Sewickley Coal lies only about 100 feet above the Pittsburgh, its outcrop is not shown on Map II, but it may easily be determined at any point desired. In the western districts of Monongalia and Marion counties where it lies under drainage it has been usually noted in oil well records, which are sufficiently numerous to show that it is generally present in good thickness. The following table shows the extent of the coal with great probability:

### List of Wells Recording Sewickley Coal.

| No. on Map                | Name of Well.                 | Location.                      | Elevation of Well Mouth A. T. | Depth Feet | Thickness Feet. |
|---------------------------|-------------------------------|--------------------------------|-------------------------------|------------|-----------------|
| <b>Monongalia County:</b> |                               |                                |                               |            |                 |
| 1                         | John E. Snyder No. 1          | St. Cloud, 1.2 m. N 30° W..... | 1425B                         | 1095       | 5               |
| 3                         | Kinzey Renner Hrs. No. 1..... | Garrison, 1.1 m. SW .....      | 1115B                         | 804        | 6               |
| 7                         | James L. White No. 1          | St. Cloud, 1 m. NE .....       | 1240B                         | 889        | 6               |
| 8                         | John G. White No. 1           | Maple, 0.7 m. W                | 1150B                         | 780        | 4               |
| 9                         | Simon L. White No. 1          | Maple .....                    | 1130B                         | 755        | ..              |
| 10                        | Thomas White No. 1            | Maple, 0.4 m. NE .....         | 1065B                         | 694        | 5               |
| 12                        | J. P. Hagan No. 2..           | Hero, 0.9 m. W..               | 1095B                         | 712        | 4               |
| 13                        | J. P. Hagan No. 1..           | Hero, 0.6 m. W..               | 1040B                         | 642        | ..              |
| 20                        | T. W. Kinnan No. 1..          | Jollytown, 1 m. SE .....       | 1060B                         | 695        | 6               |
| 23                        | Minerva Hennen No. 1          | Wise, 0.4 m. N 20° E.....      | 1050B                         | 667        | 3               |
| 26                        | Mary A. Eakin No. 1.          | Wadestown, 1.2 m. NE.....      | 1005B                         | 684        | ..              |
| 32                        | L. H. & R. Wilson No. 1.....  | Wadestown, 0.4 m. SE.....      | 1159L                         | 865        | 5               |
| 33                        | E. B. Bell No. 2239..         | Wadestown, 0.4 m. NW.....      | ....                          | 765        | ..              |
| 35                        | Elijah C. Clovis No. 1        | St. Cloud, 1.1 m. E .....      | 1165B                         | 825        | 7               |
| 37                        | Barnett Renner No. 2165.....  | St. Cloud, 0.3 m. SW .....     | 1365L                         | 1044       | ..              |
| 38                        | Nancy Hostutler No. 1.....    | St. Cloud, 0.7 m. SE .....     | 1200B                         | 890        | 5               |
| 40                        | Nancy Johnson No. 1           | St. Cloud, 1.1 m. SE .....     | 1095B                         | 756        | 4               |

| No. on Map | Name of Well.                       | Location.                                | Elevation of Well Mouth A. T. | Depth Feet | Thickness Feet. |
|------------|-------------------------------------|--|-------------------------------|------------|-----------------|
| 44A        | Marion Henderson No. 2411.....      | St. Leo, 2.2 m. NW .....                 | .....                         | 830        | ..              |
| 47         | Jacob (B. F.) Liming No. 1.....     | Cottontown, 1.3 m. E.....                | 1370B                         | 1095       | 5               |
| 50         | Amy Maple No. 1...                  | Wadestown, 2 m. St. Leo, 1.7 m. NW ..... | .....                         | 910        | ..              |
| 51         | Fred O. Liming No. 2326.....        | SW .....                                 | 1240B                         | 950        | ..              |
| 53         | John Estel Heirs No. 1.....         | St. Leo, 1 m. N 15° E.....               | .....                         | 1242       | 6               |
| 80         | M. J. Garrison No. 1.               | Wadestown, 1.2 m. SE .....               | 1120B                         | 791        | 9               |
| 86         | F. M. Efav No. 1...                 | Crossroads, 1.1 m. S 5° W.....           | .....                         | 824        | ..              |
| 87         | F. M. Efav No. 3...                 | Galletin, 1.5 m. N                       | 1115L                         | 774        | 4               |
| 88         | Amon Johnson No. 2                  | Galletin, 1.6 m. N                       | 1083L                         | 746        | 6               |
| 89         | Samuel Eakin No. 4.                 | St. Leo, 1.7 m. E..                      | 1155B                         | 865        | 8               |
| 90         | Samuel Eakin No. 1.                 | St. Leo, 1.8 m. E                        | 1125B                         | 827        | 7               |
| 93         | M. J. (Crocker) Garrison No. 1..... | Wadestown, 1.4 m. S.....                 | 1075B                         | 790        | 9               |
| 94         | M. J. Garrison No. 2.               | St. Leo, 1.4 m. NW .....                 | 1055B                         | 785        | 8               |
| 95         | Joseph Estil No. 9...               | St. Leo, 1.1 m. NE .....                 | 1105B                         | 825        | ..              |
| 96         | Wilson Haught No. 4                 | St. Leo, 0.9 m. NE .....                 | .....                         | 1148       | 4               |
| 99         | J. M. Hall No. 2....                | St. Leo, 0.2 m. N .....                  | .....                         | 1060       | ..              |
| 103        | F. M. Renner No. 1..                | St. Leo, 0.7 m. S 15° E.....             | 1103L                         | 830        | ..              |
| 107        | W. A. Yost No. 5...                 | St. Leo, 1.4 m. SE .....                 | 1295B                         | 1000       | ..              |
| 109        | T. C. Gallagher No. 2               | Galletin, 0.5 m. NE .....                | 1632L                         | 1202       | ..              |
| 117        | Corbra Anderson No. 2.....          | Ragtown, 1.3 m. SW .....                 | 1617L                         | 1220       | 7               |
| 135        | Estella & R. S. Lantz No. 1589....  | Blacksville, 0.5 m. W.....               | .....                         | 546        | ..              |
| 136        | Estella & R. S. Lantz No. 1575....  | Blacksville, 0.4 m. SW.....              | 955B                          | 490        | ..              |
| 137        | Estella & R. S. Lantz No. 1576....  | Blacksville .....                        | 953L                          | 476        | ..              |
| 147        | Sol Meyers No. 1...                 | Blacksville, 1.2 m. S.....               | 1104L                         | 655        | ..              |
| 148        | Sol Meyers No. 1...                 | Blacksville, 1.3 m. S 10° W....          | 1110B                         | 648        | ..              |
| 149        | Reason Sine No. 1...                | Blacksville, 1.5 m. S.....               | 1239L                         | 792        | ..              |
| 150        | Alpheus Sine No. 1..                | Blacksville, 1.5 m. S 5° W....           | 1152L                         | 700        | ..              |



| No. on Map | Name of Well                         | Location.                      | Elevation of Well Mouth A. T. | Depth Feet | Thickness Feet. |
|------------|--------------------------------------|--------------------------------|-------------------------------|------------|-----------------|
| 152        | Asa Lemley No. 2.                    | Blacksville, 2.1 m. S 10° W... | 1195B                         | 750        | 7               |
| 153        | James Lemley Hrs. No. 1.....         | Daybrook, 1.6 m. NW            | 1225B                         | 780        | ..              |
| 168        | Grant Stephens .....                 | Mooresville .....              | 960B                          | 394        | 7               |
| 171        | Etta Core No. 2268..                 | Worley, 0.5 m. SW .....        | 1345B                         | 808        | 7               |
| 172        | Lee R. Shriver No. 2                 | Worley, 0.6 m. NE .....        | 965B                          | 454        | ..              |
| 174        | Lee R. Shriver No. 3                 | Worley, 0.8 m. NE .....        | 975B                          | 448        | ..              |
| 176        | Lee R. Shriver No. 1                 | Worley, 0.8 m. NE .....        | 925B                          | 454        | ..              |
| 211        | D. J. Eddy.....                      | Behler, 0.5 m. S               | 1058L                         | 383.5      | 6.7             |
| 214        | C. E. Johnson No. 8..                | Pedlar, 0.8 m. SE              | 1280B                         | 680        | ..              |
| 224        | J. C. and R. Morris No. 1.....       | Core, 2 m. S 15° E             | 1205B                         | 500        | ..              |
| 230        | Martha A. Miller No. 1.....          | Hagans, 2.2 m. NE .....        | 1225                          | 488        | 6               |
| 232        | Cal Hawkins No. 1..                  | Hagans, 0.5 m. E               | .....                         | 495        | 5               |
| 233        | M. A. Miller No. 2..                 | Hagans, 0.2 m. S               | 1015B                         | 282        | 4               |
| 234        | [M. A. Miller coal test No. 9' ..... | Hagans .....                   | 1010L                         | 265        | 6.3             |
| 250        | Bowen Wade No. 2..                   | Bowlby, 0.9 m. N 20° E.....    | 1190B                         | 320        | 5               |
| 251        | Iona Bowlby No. 3..                  | Bowlby, 0.5 m. NW .....        | 1130B                         | 276        | 6               |
| 254        | Spencer Cunningham, No. 1.....       | Bowlby 1.2 m. W .....          | 1195B                         | 435        | 5               |
| 255        | Iona Bowlby No. 4..                  | Bowlby, 0.6 m. S 80° W.....    | 1220B                         | 372        | 6               |
| 256        | H. C. Bowlby No. 5..                 | Bowlby, 1.0 m. SW .....        | .....                         | 617        | 8               |
| 257        | E. Brand No. 2.....                  | Bowlby, 1.2 m. SW .....        | .....                         | 411        | 6               |
| 259        | Wm. McCormick No. 2.....             | Bowlby, 1.5 m. SW .....        | 1245B                         | 375        | 5               |
| 260        | Frank McCormick..                    | Bowlby, 1.4 m. SW .....        | 1215B                         | 350        | 6               |
| 262        | Mark Weaver No. 1..                  | Bowlby, 1.9 m. SW .....        | 1130B                         | 385        | 5               |
| 263        | Justus Brewer No. 1.                 | Cassville, 2.2 m. NE .....     | 1000B                         | 130        | 6               |
| 266        | Wm. Higgins No. 1..                  | Cassville, 0.8 m. E .....      | 955B                          | 82         | 5               |
| 267        | Mandedick Helrs coal test No. 3..... | Cassville, 0.7 m. E .....      | 963L                          | 76         | 4               |
| 269        | David Henderson No. 1.....           | Cassville, 1.3 m. S 75° W..... | 1340B                         | 586        | 6               |

| No. on Map     | Name of Well.                       | Location.                      | Elevation of Well Mouth A. T. | Depth Feet | Thickness Feet. |
|----------------|-------------------------------------|--------------------------------|-------------------------------|------------|-----------------|
| 272            | John Laird (E. Roach) No. 1.....    | Maldsville, 1.8 m. S 80° W.... | 1135B                         | 187        | 5               |
| 273            | Elza Davis No. 1...                 | Maldsville, 1.1 m. W.....      | 1050B                         | 71         | 5               |
| 274            | Wm. H. Smith No. 1.                 | Cassville, 1.1 m. W.....       | 1155B                         | 190        | 5               |
| 281            | Peter Lazzell No. 1.                | Maldsville, 1.3 NW.....        | 1170B                         | 134        | 7               |
| 283            | T. A. & J. F. Keenan No. 1.....     | Maldsville, 1.2 m. N 50° W.... | 1035B                         | 18         | 5               |
| 290            | Sanford Barrickman No. 1.....       | Cassville, 1.8 m. SE.....      | 1085B                         | 178        | 6               |
| 291            | L. S. Bircher No. 1.                | Cassville, 1.4 m. SE.....      | 1335B                         | 465        | 7               |
| 292            | J. H. Cole coal test. No. 2.....    | Cassville, 2 m. S              | 1058L                         | 219        | 5.8             |
| 294            | J. C. Brand No. 2...                | Cassville, 2 m. SW.....        | ....                          | 575        | 6               |
| 295            | Eugene Snyder No. 1                 | Hagans, 2.3 m. NE.....         | ....                          | 365        | 7               |
| 297            | Jehu Davis No. 1...                 | Hagans, 2.2 m. NE.....         | 1490B                         | 728        | 7               |
| 298            | Martha A. Miller No. 2.....         | Hagans, 2.1 m. NE.....         | 1255B                         | 518        | ..              |
| 303            | J. N. Michael coal test No. 4.....  | Hagans, 1.8 m. NE.....         | 1159L                         | 409        | 5.7             |
| 306            | Alpheus Morris No. 2 (?).....       | Hagans, 1.6 m. NE.....         | 1230B                         | 508        | 7               |
| 308            | Joseph E. Lynch coal test No. 5.... | Georgetown, 1.8 m. N.....      | 1068L                         | 268        | 5.6             |
| 309            | S. C. Stewart coal test No. 8.....  | Arnettsville, 1.8 m. NW.....   | 1083L                         | 325        | 3.2             |
| 311            | Mary J. Lynch coal test No. 10..... | Arnettsville, 1.8 m. NW.....   | 980L                          | 179        | 7.8             |
| 313            | C. M. Arnett coal test No. 7.....   | Arnettsville, 0.3 m. NW.....   | 951L                          | 115        | 5               |
| 314            | A. C. Barker coal test No. 6.....   | Georgetown, 1.2 m. NE.....     | 999L                          | 184        | 6.4             |
| 315            | E. W. Brand coal test No. 1.....    | Laurel Point, 1 m. NW.....     | 1005L                         | 117        | 7.8             |
| Marion County: |                                     |                                |                               |            |                 |
| 347            | Dorcas (T. J.) Ash No. 2.....       | Glover Gap, 1.9 m. NW.....     | 1100B                         | 814        | 3               |
| 348            | L. A. Keenan No. 1..                | Glover Gap, 1.9 m. N 30° W.... | 1135B                         | 874        | ..              |
| 349            | Rebecca Glover No. 1                | Glover Gap, 1.4 m. NW.....     | 1460B                         | 1185       | 5               |
| 351            | John Glover No. 1..                 | Glover Gap, 1.1 m. NW.....     | 1460B                         | 1185       | 5               |
| 353            | A. M. Glover No. 2..                | Glover Gap, 0.9 m. NW.....     | 1154L                         | 850        | 5               |

| No. on Map | Name of Well.                | Location.                      | Elevation of Well Mouth A. T. | Depth Feet | Thickness Feet. |
|------------|------------------------------|--------------------------------|-------------------------------|------------|-----------------|
| 354        | A. M. Glover No. 4..         | Glover Gap, 0.6 m. NW.....     | 1160B                         | 858        | 5               |
| 355        | A. M. Glover No 3..          | Glover Gap, 0.6 m. NW.....     | 1170B                         | 755        | 5               |
| 361        | Geo. W. Hamilton No. 1.....  | Seven Pines, 2.4 m. NW.....    | ....                          | 1065       | ..              |
| 364        | James Toothman No. 1.....    | Brink, 1.4 m. N..              | 1335B                         | 960        | 6               |
| 371        | Riley Arnett No. 2..         | Rymer, 1.7 m. S 85° W.....     | 1120B                         | 860        | 4               |
| 372        | Riley Arnett No. 1..         | Rymer, 1.1 m. W                | 1055B                         | 769        | 5               |
| 373        | Joseph Hayhurst No. 4.....   | Rymer, 1.1 m. NW.....          | 1065B                         | 790        | ..              |
| 377        | George Watson No. 1          | Seven Pines, 0.6 m. SE.....    | 1110B                         | 770        | 2               |
| 383        | John W. Batson No. 1.....    | Seven Pines, 1.3 m. NE.....    | 1295B                         | 984        | ..              |
| 384        | John Baker No. 4...          | Metz, 2.6 m. W.                | ....                          | 4          | 60              |
| 388        | B. Wells No. 1.....          | Glover Gap, 1 m. S 20° E.....  | 1045B                         | 700        | ..              |
| 389        | Benj. Dodd No. 3...          | Glover Gap, 0.8 m. S 5° E..... | 1255B                         | 910        | 4               |
| 393        | August Sturm No. 2.          | Glover Gap, 0.8 m N 75° E..... | 1070B                         | 750        | ..              |
| 394        | Snodgrass Bros No. 3         | Glover Gap, 0.6 m. SE.....     | 1055B                         | 712        | ..              |
| 395        | M. W. Sturm No. 2.           | Glover Gap, 1 m. m. SE.....    | ....                          | 982        | 4               |
| 400        | Barnes & Fleming No. 2.....  | Glover Gap, 1.3 m. S 80° E.... | 1320B                         | 962        | ..              |
| 410        | E. Moore Heirs No. 1         | Metz, 2 m. N...                | ....                          | 1090       | 5               |
| 412        | E. Moore Heirs No. 2         | Glover Gap, 1.9 m. E.....      | 1060B                         | 750        | 5               |
| 414        | Isaac Campbell No. 3         | Metz, 2.2 m. N..               | 1100B                         | 787        | ..              |
| 416        | Eliz. Thomas No. 1..         | Metz, 2.1 m. NE.               | 1086L                         | 800        | ..              |
| 419        | James Fox No. 1....          | Mannington, 3 m. SW.....       | 1190B                         | 910        | 5               |
| 423        | Isaac F. Thomas No. 1.....   | Galletin, 1.5 m. SW.....       | 1075B                         | 700        | ..              |
| 431        | Ash Fluharty No. 1..         | Condit.....                    | 1000L                         | 506        | ..              |
| 436        | Catherine Tennant No. 3..... | Metz, 0.9 m. SE.               | 1000B                         | 618        | 4               |
| 437        | Frank O. Price No. 1         | Metz, 1.4 m. S 10° E.....      | 1050B                         | 561        | ..              |
| 446        | C. S. Pitzer No. 1...        | Rymer, 1.3 m. N 80° E.....     | 1320B                         | 885        | 5               |
| 447        | J. L. Beatty No. 1...        | Logansport, 1.2 m. N.....      | 1130B                         | 678        | 5               |
| 448        | A. J. Hayes No. 8...         | Rymer, 1.1 m. NE.....          | 1300B                         | 910        | 7               |
| 449        | Benj. Grubb No. 3...         | Rymer, 1 m. NE.                | 1080B                         | 700        | ..              |

| No. on Map | Name of Well                       | Location                           | Elevation of Well Mouth A. T. | Depth Feet | Thickness Feet. |
|------------|------------------------------------|------------------------------------|-------------------------------|------------|-----------------|
| 453        | A. J. Hayes No. 13..               | Rymer, 0.7 m.<br>N 80° E.....      | 1025B                         | 628        | 5               |
| 460        | Jonathan Arnett<br>No. 1.....      | Curtisville, 0.5<br>m. NW .....    | 1055B                         | 714        | ..              |
| 462        | W. N. Cunningham<br>ham No. 4..... | Curtisville, 1.3<br>m. N 85° W...  | 1075B                         | 804        | 5               |
| 464        | Jacob Cunningham<br>No. 9.....     | Curtisville, 1.4<br>m. S 75° W.... | 1070B                         | 800        | 5               |
| 465        | Jacob Cunningham<br>No. 3.....     | Curtisville, 1.8<br>m. S 70° W.... | 1155B                         | 935        | ..              |
| 469        | Alexander Huey<br>No. 1.....       | Curtisville, 1.3<br>m. S.....      | ....                          | 722        | 8               |
| 471        | M. W. Huey Heirs<br>No. 1.....     | Pleasantville, 2.4<br>m. NW.....   | 1320B                         | 860        | 5               |
| 472        | J. A. Harbert No. 1..              | Pleasantville, 2.4<br>m. NW .....  | 1085B                         | 630        | 4               |
| 472A       | Geo. A. Huey No. 1..               | Pleasantville, 2.5<br>m. NW .....  | 1350B                         | 870        | ..              |
| 487        | Daniel Varner No. 1.               | Condit, 1.8 m.<br>N 80° E.....     | 1155B                         | 610        | ..              |
| 489        | Columbus Snodgrass<br>No. 1.....   | Condit, 1.4 m. E.                  | 1060B                         | 510        | 5               |
| 490        | Thornton Fluharty<br>No. 1.....    | Condit, 1.1 m. SE                  | 1055B                         | 475        | ..              |
| 498        | James Fluharty<br>No. 1.....       | Mannington, 2.4<br>m. N 25° E...   | 1305B                         | 714        | ..              |
| 499        | E. Wilson No. 1....                | Mannington, 2.4<br>m. N 30° E....  | 1180B                         | 595        | ..              |
| 501        | Ozias Kuhn No. 1..                 | Mannington, 2<br>m. N 30° E....    | ....                          | 585        | ..              |
| 502        | B. F. Blackshere<br>No. 15.....    | Downs, 0.6 m.<br>NW .....          | 1250B                         | 530        | ..              |
| 536        | Lindsay Blaker No. 1               | Pleasantville, 0.7<br>m. NE .....  | 1115B                         | 328        | 2               |
| 541        | Fleming Hamilton<br>No. 1.....     | Mannington, 0.5<br>m. S.....       | 1055B                         | 345        | 12              |
| 555        | Brice Wallace No. 1.               | Fairview, 1 m.<br>NE .....         | 1025B                         | 420        | 10              |
| 556        | David Jones No. 5..                | Fairview, 0.9 m.<br>N. 10° W.....  | ....                          | 595        | 7               |
| 574        | U. G. King No. 1791.               | Fairview, 1.8 m.<br>SE .....       | 972L                          | 140        | ..              |
| 577        | Ulysses M. Price<br>No. 1.....     | McCurdyville,<br>1.1 m. SE.....    | ....                          | 711        | ..              |
| 585        | J. W. Williams No. 1.              | Arnettsville, 1.4<br>m. W.....     | 1199L                         | 390        | 5               |
| 591        | Wm. Wallace No. 1.                 | Fairview, 2.1 m.<br>SW .....       | 1110B                         | 470        | 10              |
| 597        | A. O. Talkington<br>No. 7.....     | Downs, 1.5 m. N                    | 1105B                         | 410        | ..              |
| 599        | Rezin Amos No. 1...                | Downs, 1.3 m. N                    | 1117L                         | 380        | 7               |

| No. on Map | Name of Well                           | Location                        | Elevation of Well Mouth A. T. | Depth Feet | Thickness Feet. |
|------------|--|---------------------------------|-------------------------------|------------|-----------------|
| 600        | L. D. Martin No. 1.                    | Downs, 1.2 m. NE                | ....                          | 550        | ..              |
| 621        | Morgan-Fox core test No. 14.....       | Farmington, 0.5 m. N.....       | 998L                          | 209        | 6               |
| 623        | Jessie B. Martin core test No. 10...   | Farmington, 1.4 m. SW.....      | 936L                          | 118.5      | 5               |
| 625        | E. T. Wood core test No. 3.....        | Downs, 1.3 m. SE .....          | 974L                          | 174.5      | 5               |
| 628        | D. C. Jones No. 2449.                  | Annabelle, 2.2 m. NW .....      | 1245B                         | 499        | 5               |
| 629        | H. R. Glover No. 1885                  | Annabelle, 2.2 m. N 70° W...    | 1210B                         | 445        | 5               |
| 634A       | Absalom Martin core test No. 1...      | Festus, 2 m. NW                 | 1122L                         | 315        | 5               |
| 635        | A. A. Parrish No. 805                  | Annabelle, 1 m. N 35° E.....    | 1285B                         | 480        | 6               |
| 639        | W. S. Parrish No. 2197.....            | Festus, 0.7 m. N 30° W.....     | 1240B                         | 453        | 4               |
| 639A       | Olive Minnear core test No. 2.....     | Festus, 0.8 m. NW .....         | 1007L                         | 138.5      | 6               |
| 640        | A. Martin No. 2165..                   | Annabelle .....                 | 1155B                         | 280        | 5               |
| 640A       | Jane Downs core test No. 4.....        | Annabelle, 0.4 m. NW.....       | 1064L                         | 207        | 6.2             |
| 641        | Mattie C. Sturm No 1.....              | Sturms Mill, 0.8 m. N.....      | 1035B                         | 60         | ..              |
| 642        | E. H. Stephens No. 2138.....           | Sturms Mill, 0.5 m. E.....      | 1033L                         | 70         | 3               |
| 646        | Z. F. Davis core test No. 4.....       | Worthington, 1.3 m. N.....      | 965L                          | 68.5       | 6               |
| 647        | W. P. Fortney core test No. 3.....     | Worthington, 1 m. NW.....       | 918L                          | 47.5       | 6               |
| 651        | Marvin Tetrick (E. Straight) No. 2148. | Worthington, 1.4 m. W.....      | 1220B                         | 348        | ..              |
| 652        | Nancy Billingsley core test No. 5...   | Hutchinson, 0.5 m. NW.....      | 994L                          | 80         | 0.3             |
| 653        | Wm. F. Sandy core test No. 12.....     | Hutchinson, 0.5 m. W.....       | 1101L                         | 155        | 2.2             |
| 654        | J. L. Davis core test                  | Farmington, 0.7 m. E.....       | 923L                          | 115        | 6.3             |
| 655        | Curtis Fletcher core test No. 9.....   | Farmington, 1 m. E.....         | 918L                          | 82         | 5.7             |
| 659        | Nancy Martin core test No. 6.....      | Monongah, 1.4 m. NW.....        | 998L                          | 95         | 6.5             |
| 665        | Lewis Hall No. 1...                    | Barrackville, 1.4 m. N 20° W... | 1065B                         | 300        | 5               |
| 669        | Morgan-Billingslee core test No. 8.... | Barrackville, 1.8 m. W.....     | 914L                          | 89.5       | 9.5             |
| 672        | Shore core test No. 7                  | Fairmont, 1 m. NW .....         | 984L                          | 150        | 5.5             |

With the information contained in the foregoing table and with observations made at outcrop which show that the Sewickley coal is not found east of the Monongahela river, except in a small tract in Union district, Monongalia county, the following estimates have been made by Reger, using an average thickness of 4.5 feet and making a slight assumption regarding the outcrop, as explained in the table:

### Available Sewickley Coal West of Monongahela River.

Planimeter formula:

Sewickley coal equals Pittsburgh coal minus outcrop of same in miles multiplied by 0.1.

| Counties by Districts.      | Square Miles. | Acres.         | Cubic Feet of Coal.   | Short Tons. of Coal. |
|-----------------------------|---------------|----------------|-----------------------|----------------------|
| <b>Monongalia:</b>          |               |                |                       |                      |
| Battelle .....              | 56.40         | 36,096         | 7,075,537,920         | 283,021,517          |
| Clay .....                  | 63.49         | 40,634         | 7,965,076,680         | 318,631,067          |
| Cass .....                  | 28.04         | 17,946         | 3,517,774,920         | 140,710,997          |
| Grant .....                 | 32.23         | 20,627         | 4,043,304,540         | 161,732,182          |
| <b>Totals .....</b>         | <b>180.16</b> | <b>115,303</b> | <b>22,601,694,060</b> | <b>904,095,763</b>   |
| <b>Marion:</b>              |               |                |                       |                      |
| Mannington .....            | 100.09        | 64,058         | 12,556,649,160        | 502,265,966          |
| Pawpaw .....                | 38.49         | 24,634         | 4,828,756,680         | 193,150,267          |
| Lincoln .....               | 56.02         | 35,853         | 7,081,905,060         | 283,276,202          |
| Fairmont .....              | 19.29         | 12,346         | 2,420,062,920         | 96,302,517           |
| <b>Totals .....</b>         | <b>213.89</b> | <b>136,891</b> | <b>26,887,373,820</b> | <b>1,075,494,952</b> |
| <b>Totals for area.....</b> | <b>394.05</b> | <b>252,194</b> | <b>49,489,067,880</b> | <b>1,979,590,715</b> |

### *The Redstone Coal.*

The Redstone coal, which overlies the Pittsburgh coal by an interval varying from 20 to 40 feet, is commercially important only in a small portion of Cass and Grant districts, Monongalia county. In all other regions where the horizon crops there is no coal. In the western portions of Monongalia and Marion counties, where its horizon has been pierced by hundreds of oil wells, the coal is nearly always absent. The coal has been mined for local use in the part of Monongalia county mentioned and has given good results, but there are no mines in it now, owing to the more easily available Pittsburgh coal below. The only sample collected from it was at a hill-side prospect where mud seams had filtered into the vein, making the analysis show a high percentage of ash and a high oxygen content and a corresponding low heat value. If the



coal is mined it must be done before the Pittsburgh is taken from beneath it, as the intervening strata are too thin to remain in place.

### Available Redstone Coal.

The following table shows the only wells that record Redstone coal in the territory of this report.

#### List of Wells Recording Redstone Coal.

| No. on Map.               | NAME OF WELL.                           | LOCATION.                       | Elevation of Well Mouth, A. T. | Depth, Feet. | Thickness, Feet. |
|---------------------------|---|---------------------------------|--------------------------------|--------------|------------------|
| <b>Monongalia County:</b> |   |                                 |                                |              |                  |
| 168                       | Grant Stephens.....                     | Mooreville .....                | 960B                           | 449          | 1                |
| 211                       | D. J. Eddy.....                         | Behler, 0.5 m. S.               | 1058L                          | 439          | 1                |
| 232                       | Cal Hawkins No. 1..                     | Hagans, 0.5 m. E                | ....                           | 559          | 4                |
| 234                       | M. A. Miller coal test No. 9.....       | Hagans .....                    | 1010                           | 329          | 4.1              |
| 250                       | Bowen Wade No. 2..                      | Bowlby, 0.9 m. N 20° E.....     | 1190B                          | 382          | 4                |
| 251                       | Iona Bowlby No. 3..                     | Bowlby, 0.5 m. NW.....          | 1130B                          | 361          | 5                |
| 267                       | Mankedick Heirs coal test No. 3.....    | Cassville, 0.7 m. E.....        | 963L                           | 136          | 1.8              |
| 273                       | Elza Davis No. 1....                    | Maldsville, 1.1 m. W.....       | 1050B                          | 147          | 5                |
| 283                       | T. A. and J. F. Keenan No. 1.....       | Maldsville, 1.2 m. N 50° W..... | 1035B                          | 86           | 4                |
| 292                       | J. H. Cole coal test No. 2.....         | Cassville, 2 m. S.              | 1058L                          | 279          | 2.2              |
| 303                       | J. N. Michael coal test No. 4.....      | Hagans, 1.8 m. NE.....          | 1159L                          | 463          | 1.2              |
| 308                       | Joseph E. Lynch coal test No. 5.....    | Georgetown, 1.8 m. N.....       | 1068L                          | 324          | 1.7              |
| 311                       | Mary J. Lynch coal test No. 10.....     | Arnettsville, 1.8 m. NW.....    | 980L                           | 236          | 1                |
| 314                       | A. C. Barker coal test No. 6.....       | Georgetown, 1.2 m. NE.....      | 999L                           | 245          | 2                |
| 315                       | E. W. Brand coal test No. 1.....        | Laurel Point, 1 m. NW.....      | 1005                           | 188          | 0.1              |
| <b>Marion County:</b>     |   |                                 |                                |              |                  |
| 515                       | J. W. Conaway No. 3.                    | Mannington, 2.2 m. SW.....      | 1064B                          | 472          | 4                |
| 627                       | James Morgan (Silas Stark) No. 1894.... | Annabelle, 1.1 m. NW.....       | 1112L                          | 302          | ..               |
| 643                       | Mary Hawkins core test No. 13.....      | Sturms Mill, 0.6 m. SE.....     | 946L                           | 43           | 0.8              |

By assuming a thickness of 4 feet for the Redstone coal in the region indicated on the figure the following computation and estimate was made by Reger:



**Available Redstone Coal.**

| County.          | Square Miles. | Acres.  | Cubic Feet. of Coal. | Short Tons of Coal. |
|------------------|---------------|---------|----------------------|---------------------|
| Monongalia ..... | 11.27         | 7,212.8 | 125,675,828          | 5,027,032           |

***The Pittsburgh Coal.***

The Pittsburgh coal, which has been described in Chapter VI, is the most valuable single mineral resource of the territory of this report. Being of greater purity than the Sewickley and of greater regularity than the Redstone it has been mined much more extensively than these coals. Since it underlies them both by a short interval it is quite probable that these two coals will be greatly injured and in places rendered unavailable for mining unless greater care is taken to protect them. The intervening strata are generally too thin and unstable to remain in place after the Pittsburgh coal has been removed.

In the region of Monongalia and Marion counties, west of the present mining zone, but little is known concerning the chemical character of the coal. A sample was collected from the bailer by the driller of the T. W. Kinnan (20) gas well in Battelle district, Monongalia county, the analysis of which is published in the table at the end of this chapter. Whether the coal in the region mentioned is of a suitable character for coke manufacture is a question that cannot be answered until core tests have been made.

Of the commercial mines all were sampled for analysis, one sample being usually taken, the only exceptions being at some of the larger shaft operations in Marion county, where additional samples were thought necessary. The Table of Coal Analyses at the end of this chapter shows the results of this work. Since there are commercial mines in nearly all localities where the coal crops only one sample was taken from a farm mine, this one being located near Stewartstown, Monongalia county, where there is no commercial mine. The samples of the commercial mines were taken according to the methods advocated by the U. S. Bureau of Mines and the analyses were made by standard methods in the Survey labora-

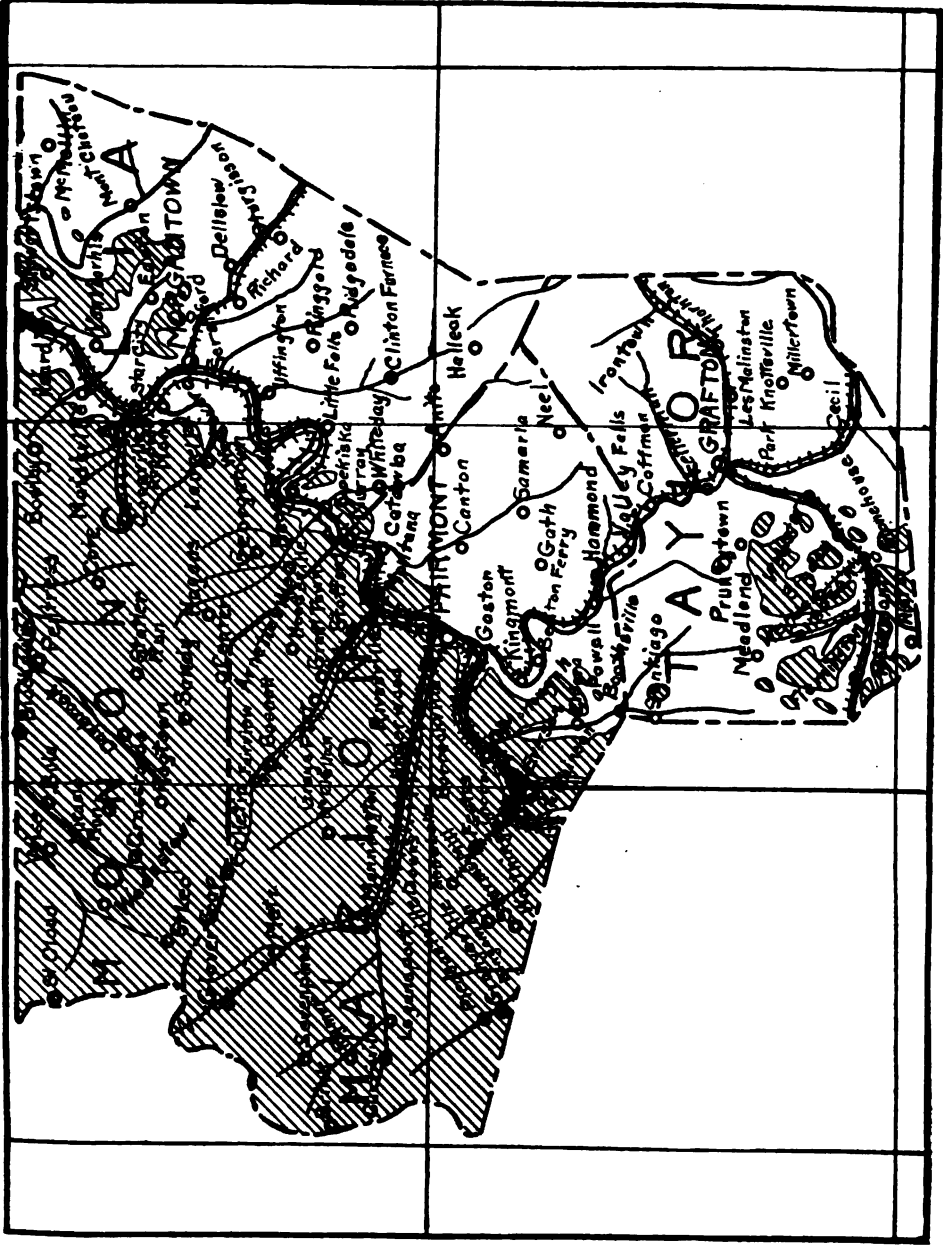


Figure 8.—Showing area of Pittsburgh Coal.

tory. The detailed descriptions of the mines, giving a carefully measured section at the working face where the sample was taken in each mine, are published in the following pages.

**Wm. Robinson Farm Mine—No. 16 on Map II.**

Located  $\frac{1}{4}$  mile south of Stewartstown; Pittsburgh coal.

|  |                   | Feet. | Inches.         |
|--|-------------------|-------|-----------------|
| 1. Sandstone, massive, Pittsburgh..... |                   | 35    | 00              |
| 2. Coal, very slaty.....               | 1' 3 "            |       |                 |
| 3. Coal, slaty.....                    | 1 8               |       |                 |
| 4. Coal.....                           | 0 5               |       |                 |
| 5. Slate.....                          | 0 1               |       |                 |
| 6. Coal.....                           | 2 0               |       |                 |
| 7. Slate.....                          | 0 0 $\frac{1}{4}$ |       |                 |
| 8. Coal.....                           | 0 9               |       |                 |
| 9. Slate.....                          | 0 0 $\frac{1}{2}$ |       |                 |
| 10. Coal.....                          | 4 11              | 11    | 1 $\frac{1}{4}$ |

11. Slate.

On account of the poor drainage in this mine, the sample was collected from the stock pile at the pit mouth.

**Elkins Coal & Coke Co. No. 5 (Fulmer)—No. 17 on Map II.**

Located 2 miles northeast of Morgantown; Pittsburgh coal.

|                               |        | Feet. | Inches. |
|-------------------------------|--------|-------|---------|
| 1. Sandstone, Pittsburgh..... |        | 25    | 0       |
| 2. Draw slate.....            |        | 0     | 6       |
| 3. Coal, breast.....          | 1' 8 " |       |         |
| 4. Bands.....                 | 0 6    |       |         |
| 5. Coal, bottom.....          | 5 4    | 7     | 6       |

Section republished from Vol. II, W. Va. G. S., page 173; analysis republished from Vol. II(A), page 668.

**Great Scott Coal & Coke Co., Great Scott Mine.—No. 18 on Map II.**

Located  $\frac{1}{4}$  mile south of Randall; Pittsburgh coal.

|                               |                   | Feet. | Inches.         |
|-------------------------------|-------------------|-------|-----------------|
| 1. Slate, black.....          |                   |       |                 |
| 2. Coal.....                  | 0' 3 "            |       |                 |
| 3. Shale, gray.....           | 1 6               |       |                 |
| 4. Wild coal, hard, bony..... | 0 10              |       |                 |
| 5. Shale, gray.....           | 0 8               |       |                 |
| 6. Coal, good.....            | 1 3               |       |                 |
| 7. Coal, bony.....            | 0 3               |       |                 |
| 8. Coal, good.....            | 1 0               |       |                 |
| 9. Slate, black.....          | 0 0 $\frac{1}{2}$ |       |                 |
| 10. Coal.....                 | 1 6               |       |                 |
| 11. Bone.....                 | 0 0 $\frac{1}{4}$ |       |                 |
| 12. Coal.....                 | 0 4 $\frac{1}{2}$ |       |                 |
| 13. Bone.....                 | 0 0 $\frac{1}{4}$ |       |                 |
| 14. Coal.....                 | 4 1               | 11    | 9 $\frac{1}{2}$ |
| 15. Shale, gray.....          |                   |       |                 |

"Tidal elevation, 925', aneroid, at new opening; principal office, Morgantown; daily capacity, 500 tons; average output, 50 tons; 2 laborers and 5 miners employed; horse haulage and gravity cable to railroad; used for steam and domestic fuel; shipped east and west; butts, N 69° 30' W; faces N 20° 30' E; greatest rise, southeast; usual sample collected for analysis from Nos. 8, 10, 11, 12, 13 and 14; sample also collected from Nos. 6 and 7 in Room No. 3, First Butt Right, by D. B. Reger; Gordon Tait, Supt., authority for data."

**Antler Coal Co., Grant Mine.—No. 19 on Map II.**

Located 0.4 mile west of Roundbottom; Pittsburgh coal.

|                      | Feet. | Inches. |
|----------------------|-------|---------|
| 1. Draw slate.....   |       |         |
| 2. Coal, head.....   | 0' 8  | "       |
| 3. Coal, good.....   | 1 6   |         |
| 4. Slate, black..... | 0 0½  |         |
| 5. Coal.....         | 1 8   |         |
| 6. Bone.....         | 0 0¾  |         |
| 7. Coal.....         | 3 11  | 7 2¼    |
| 8. Shale, gray.      |       |         |

"Tidal elevation, 1168', hand level; principal office, Fairmont; daily capacity, 300 tons; 11 laborers and 40 miners employed; horse haulage and gravity cable to railroad; used for gas, steam and domestic fuel, shipped to lake and local trade; butts N 78° W; faces N 12° E; greatest rise, S 45° E; sample collected from Nos. 3, 5, 6 and 7 in Kirk Heading, by D. B. Reger. Charles Gandy, Supt., authority for data."

**Consolidation Coal Co. No. 30 (Beechwood).—No. 20 on Map II.**

Located at Beechwood; Pittsburgh coal.

|                      | Feet. | Inches. |
|----------------------|-------|---------|
| 1. Draw slate.....   |       |         |
| 2. Coal, bony.....   | 0' 7  | "       |
| 3. Coal, good.....   | 0 11  |         |
| 4. Slate, black..... | 0 1   |         |
| 5. Coal.....         | 1 5½  |         |
| 6. Bone.....         | 0 0½  |         |
| 7. Coal.....         | 0 2½  |         |
| 8. Bone.....         | 0 0¼  |         |
| 9. Coal.....         | 0 2   |         |
| 10. Bone.....        | 0 0½  |         |
| 11. Coal.....        | 4 2   | 7 8¼    |
| 12. Shale, gray.     |       |         |

"Tidal elevation, 968', spirit level; principal office, Fairmont; daily capacity, 350 tons; 20 laborers and 40 miners employed; electric haulage; used for railroad fuel; shipped east; butts, N 76° 09' W; faces, N 13° 51' E; greatest rise, northeast; sample collected from Nos. 5 to 11, inclusive, of section in No. 2 Pillar on First Left of No. 3 Opening, by D. B. Reger; H. S. Toothman, Supt., authority for data."

A former sample from this mine is published in Vol. II (A), W. Va. G. S., page 643.

**Pittsburgh Steam Coal Co., Opekiska Mine.—No. 21 on Map II.**

Located  $\frac{1}{2}$  mile south of Opekiska; Pittsburgh coal.

|                            | Feet.   | Inches. |
|----------------------------|---------|---------|
| 1. Sandstone, massive..... |         |         |
| 2. Coal, bony.....         | 0' 11 " |         |
| 3. Coal .....              | 1 8     |         |
| 4. Bone .....              | 0 0½    |         |
| 5. Coal .....              | 0 5½    |         |
| 6. Bone .....              | 0 0¾    |         |
| 7. Coal .....              | 4 3     | 7 4¾    |
| 8. Shale, gray.....        |         |         |

"Tidal elevation, 1152', hand level; principal office, Fairmont; daily capacity, 75 tons; 11 laborers and 16 miners employed; horse and rope haulage; used for steam and coke; shipped north; butts, N 78° W; faces, N 12° E; greatest rise, south; sample collected for analysis from Nos. 3 to 7 inclusive, of section in Room No. 5 of No. 4 Butt, by D. B. Reger; Charles Cox, assistant foreman, authority for data."

This company has 19 coke ovens in operation. A sample collected from 48 hour coke by Reger shows the following analysis according to Messrs. Hite and Krak.

|                          | Sample as Received. |
|--------------------------|---------------------|
|                          | Per cent.           |
| Moisture .....           | 0.28                |
| Volatile Matter.....     | 1.47                |
| Fixed Carbon.....        | 88.49               |
| Ash .....                | 9.76                |
| Total .....              | 100.00              |
| Sulphur .....            | 1.65                |
| Phosphorus .....         | 0.019               |
| "No loss on air drying." |                     |

A former sample from this mine was published in Vol. II(A), W. Va. G. S., page 643.

**Consolidation Coal Co. No. 45 (Murray)—No. 22 on Map II.**

Located at Murray; Pittsburgh coal.

|                            | Feet.  | Inches. |
|----------------------------|--------|---------|
| 1. Sandstone, massive..... |        |         |
| 2. Shale, gray.....        | 0' 4 " |         |
| 3. Coal, good, head.....   | 1 3    |         |
| 4. Coal .....              | 2 0    |         |
| 5. Bone .....              | 0 0½   |         |
| 6. Coal .....              | 0 5½   |         |
| 7. Bone .....              | 0 0½   |         |
| 8. Coal .....              | 4 3    | 8 4½    |
| 9. Shale, gray.....        |        |         |

"Tidal elevation, 943', spirit level; principal office, Fairmont; daily capacity, 350 tons; 35 laborers and 35 miners employed; rope haulage, steam and electric drive; used for steam; shipped west; butts N 71° 30' W; faces N 18° 30' E; greatest rise, S 54° E; sample collected for analysis from cross heading near pit mouth by D. B. Reger; W. H. Hess, Superintendent, authority for data."

A former sample from this mine was published in Vol. II(A), W. Va. G. S., page 643.

### Catawba Coal Co., Catawba Mine.—No. 23 on Map II.

Located  $\frac{3}{4}$  mile southwest of Catawba; Pittsburgh coal.

|                    | Feet. | Inches.         |       |      |
|--------------------|-------|-----------------|-------|------|
| 1. Draw slate..... |       |                 |       |      |
| 2. Coal, head..... | 1'    | 9 "             |       |      |
| 3. Coal.....       | 1     | 8               |       |      |
| 4. Bone.....       | 0     | 0 $\frac{7}{8}$ |       |      |
| 5. Coal.....       | 0     | 2               |       |      |
| 6. Bone.....       | 0     | 0 $\frac{5}{8}$ |       |      |
| 7. Coal.....       | 0     | 2               |       |      |
| 8. Bone.....       | 0     | 0 $\frac{1}{2}$ |       |      |
| 9. Coal.....       | 4     | 0               | ..... | 7 11 |

10. Shale, gray, soft.

"Tidal elevation, 1198', hand level; principal office, Connellsville, Pa.; daily capacity, 100 tons; 4 laborers and 12 miners employed; horse haulage; used for domestic fuel; shipped north and west; butts, N 76° W; faces, N 14° E; greatest rise, southeast; sample collected for analysis from Nos. 3, 5, 6, 7, 8 and 9 of section by D. B. Reger; G. T. Rodeheaver, Supt., authority for data."

### Pittsburgh Steam Coal Co., Elizabeth Mine.—No. 24 on Map II.

Located  $\frac{3}{4}$  mile east of Montana. Pittsburgh coal.

|                          | Feet. | Inches.         |       |                   |
|--------------------------|-------|-----------------|-------|-------------------|
| 1. Draw slate.....       |       |                 |       |                   |
| 2. Coal, bony, head..... | 1'    | 2 "             |       |                   |
| 3. Coal.....             | 2     | 0               |       |                   |
| 4. Bone.....             | 0     | 1               |       |                   |
| 5. Coal.....             | 0     | 2               |       |                   |
| 6. Bone.....             | 0     | 0 $\frac{7}{8}$ |       |                   |
| 7. Coal.....             | 0     | 2 $\frac{1}{2}$ |       |                   |
| 8. Bone.....             | 0     | 0 $\frac{1}{2}$ |       |                   |
| 9. Coal.....             | 4     | 1               | ..... | 7 9 $\frac{7}{8}$ |

10. Shale, gray.

"Tidal elevation, 985', hand level; principal office, Fairmont; daily capacity, 150 tons; 7 laborers and 17 miners employed; horse haulage; used for steam; butts, N 69° 15' W; faces, N 20° 45' E; greatest rise N. 34° 09' W. Sample collected for analysis from Nos. 3, 5, 7, 8 and 9 of section by D. B. Reger; Eli Stewart, foreman, authority for data."

Virginia & Pittsburgh Coal & Coke Co., Morgan Mine.—No.  
25 on Map II.

Located  $\frac{1}{2}$  mile east of Montana; Pittsburgh coal.

|                    | Feet              | Inches.           |
|--------------------|-------------------|-------------------|
| 1. Draw slate..... |                   |                   |
| 2. Coal, head..... | 0' 9 "            |                   |
| 3. Coal, good..... | 2 1               |                   |
| 4. Bone.....       | 0 0 $\frac{3}{8}$ |                   |
| 5. Coal.....       | 0 2               |                   |
| 6. Bone.....       | 0 0 $\frac{3}{8}$ |                   |
| 7. Coal.....       | 0 2 $\frac{1}{2}$ |                   |
| 8. Bone.....       | 0 0 $\frac{3}{8}$ |                   |
| 9. Coal.....       | 3 11              | 7 3 $\frac{3}{4}$ |

10. Shale, gray.

"Tidal elevation, 938', hand level; principal office, Fairmont; daily capacity, 200 tons; 15 laborers and 32 miners employed; mule haulage; used for gas and steam; shipped east; butts, N 78° W; faces, N 12° E; greatest rise, east; sample collected for analysis from Nos. 3 to 9, inclusive, of section in Second Butt by D. B. Reger; M. C. Hite, Supt., authority for data."

Consolidation Coal Co. No. 24 (Montana.)—No. 26 on Map II.

Located at Montana; Pittsburgh coal.

|                    | Feet              | Inches. |
|--------------------|-------------------|---------|
| 1. Draw slate..... |                   |         |
| 2. Coal, bony..... | 0' 5 "            |         |
| 3. Coal, good..... | 1 8 $\frac{1}{2}$ |         |
| 4. Bone.....       | 0 0 $\frac{1}{2}$ |         |
| 5. Coal.....       | 0 6               |         |
| 6. Bone.....       | 0 0 $\frac{3}{8}$ |         |
| 7. Coal.....       | 0 5 $\frac{1}{2}$ |         |
| 8. Bone.....       | 0 0 $\frac{3}{8}$ |         |
| 9. Coal.....       | 3 6               | 6 9     |

10. Shale, gray.

"Tidal elevation, 869', spirit level; principal office, Fairmont; daily capacity, 800 tons; 90 laborers and 85 miners employed; rope and electric haulage; used for steam, gas and coke; shipped west; butts, N 77° 30' W; faces, N 12° 30' E; greatest rise, southeast; sample collected for analysis from Nos. 3 to 9 inclusive, in No. 9 Butt on Second Level by D. B. Reger; H. M. Smith, Supt., authority for data."

A former sample was published from this mine in Vol. II(A), W. Va. G. S., page 643.







PLATE XXIX.—Mine of the New Central Coal & Coke Company (No. 28 on Map II) in the Pittsburgh Coal at Surf-  
ford, Marion County Topography of the Mountain State



**Federal Coal & Coke Co. Mine.—No. 27 on Map II.**

Located at Grant Town; Pittsburgh coal.

|                           | Feet. | Inches. |
|---------------------------|-------|---------|
| 1. Black slate, roof..... |       |         |
| 2. Coal .....             | 2' 6" |         |
| 3. Band .....             | 0     | 0¼      |
| 4. Coal .....             | 0     | 6       |
| 5. Band .....             | 0     | 0¼      |
| 6. Coal .....             | 3     | 6       |
| 7. Coal, bottom .....     | 1 0   | 7 6½    |
| 8. Slate                  |       |         |

"Tidal elevation, 680', spirit level; principal office, Grant Town; daily capacity, 2000 tons; 250 miners and 150 laborers employed; electric haulage; used for coke and gas; shipped east; butts, N., 77½° W.; faces N. 12½° E.; greatest rise, south; sample collected in Room No. 3, off Fourth East Entry by Ray V. Hennen; regular sample taken from Nos. 2, 3, 4, 5 and 6 of section and additional sample taken from bottom coal. J. W. Devison, Supt., authority for data. Only Nos. 2-6 are mined, No. 7 being left down on account of being high in sulphur, and as a rule this bottom coal is only 6" to 8" thick."

The New England Gas & Coke Company of Boston, Mass., which utilizes a large part of the product of this mine, has furnished, through its general manager, Capt. W. E. McKay, the following statistics regarding its use in by-product ovens:

|  |                                  |
|--|----------------------------------|
| Average yield of coke.....   | 70 per cent of coal.             |
| Average yield of ammonia (N H <sub>3</sub> ).....  | 24 lbs. per net ton of coal.     |
| Average yield of tar .....   | 11½ gal. per net ton of coal.    |
| Average quantity of illuminating gas corrected to 60° F. and 30 in. barometer pressure ..... | 5000 cu. ft. per net ton of coal |
| British Thermal Units in illuminating gas.....   | 640 per cu. ft.                  |
| British Thermal Units in fuel gas.....   | 620 per cu. ft.                  |
| Average price received for coke .....  | \$3.75 per net ton.              |
| Average price received for ammonia....   | 0.0285 per lb.                   |
| Average price received for tar.....  | 0.02675 per gal.                 |

**New Central Coal Co., Stafford Mine.—No. 28 on Map II.**

Located at Stafford; Pittsburgh coal.

|                                | Feet. | Inches. |
|--------------------------------|-------|---------|
| 1. Slate .....                 |       |         |
| 2. Coal, roof.....             | 1' 0" |         |
| 3. Coal .....                  | 2     | 6       |
| 4. Band .....                  | 0     | 0¼      |
| 5. Coal .....                  | 0     | 6       |
| 6. Band .....                  | 0     | 0¼      |
| 7. Coal .....                  | 3     | 8       |
| 8. Coal, sulphurous, 6" to.... | 0 8   | 8 4½    |
| 9. Slate.                      |       |         |

"Tidal elevation, 638', aneroid; principal office, Fairmont; daily capacity, 1500 tons; 275 men employed; compressed air haulage; used for steam and gas; shipped east; butts, N. 77½° W.; faces, N. 12½° E.; greatest rise north; sample collected for analysis from Nos. 3-7, inclusive, of section at working face of No. 2 East Heading by Ray V. Hennen; Nos. 2 and 8 have been objectionable for gas on account of higher sulphur content; G. S. Phillips, Supt., authority for data."

**Dakota Coal & Coke Co., Dakota No. 2 Mine—No. 29  
on Map II.**

Located at Dakota; Pittsburgh coal.

|                       |        | Feet. | Inches. |
|-----------------------|--------|-------|---------|
| 1. Draw slate .....   |        |       |         |
| 2. Roof coal .....    | 1' 0 " |       |         |
| 3. Coal .....         | 2 3½   |       |         |
| 4. Bone .....         | 0 1    |       |         |
| 5. Coal .....         | 0 2½   |       |         |
| 6. Bone .....         | 0 0½   |       |         |
| 7. Coal .....         | 0 2½   |       |         |
| 8. Bone .....         | 0 0½   |       |         |
| 9. Coal .....         | 4 6    | 8     | 4½      |
| 10. Shale, gray ..... |        |       |         |

"Tidal elevation, 671', hand level; principal office, Drawer 915, Pittsburgh, Pa.; daily capacity, 275 tons; 38 laborers and 28 miners employed; mule haulage; used for gas; shipped west; butts, N. 76° W.; faces, N. 14° E.; greatest rise, northwest; sample collected for analysis from Nos. 3, 5, 6, 7, 8 and 9 of section in Room No. 2 of No. 2 Butt by D. B. Reger; E. B. Rowe, general superintendent; authority for data."

**Jamison Coal & Coke Co. No. 9.—No. 30 on Map II.**

Located at James Fork; Pittsburgh coal.

|                       |        | Feet. | Inces. |
|-----------------------|--------|-------|--------|
| 1. Draw slate .....   |        |       |        |
| 2. Coal, head .....   | 1' 4 " |       |        |
| 3. Coal .....         | 1 8    |       |        |
| 4. Bone .....         | 0 0½   |       |        |
| 5. Coal .....         | 0 0½   |       |        |
| 6. Bone .....         | 0 0¼   |       |        |
| 7. Coal .....         | 0 3½   |       |        |
| 8. Bone .....         | 0 0½   |       |        |
| 9. Coal .....         | 3 10   |       |        |
| 10. Bottom coal ..... | 0 8    | 7     | 11¼    |

"Tidal elevation, 681', spirit level; principal office, Oliver Building, Pittsburgh, Pa.; daily capacity, 1000 tons; 75 laborers and 98 miners employed; compressed air haulage; used for gas and coke; shipped east; butts N. 77°, 30' W.; faces, N. 12°, 30' E.; stratum is





PLATE XXX.—Mine No. 8 of the Jamison Coal & Coke Co. (No. 31 on Map II) at Underwood, Marlon County.  
Buildings made of Waynesburk Sandstone.

11

level; first sample collected for analysis from Nos. 3 to 9, inclusive, of section in room No. 1, No. 7 Butt, South A, by D. B. Reger; M. W. Head, general superintendent; G. H. Musgrove, Chief Clerk, authority for data."

### Jamison Coal & Coke Co. No. 9.—No. 30 on Map II.

Located at James Fork; Pittsburgh coal.

|                     |        | Feet. | Inches. |
|---------------------|--------|-------|---------|
| 1. Draw Slate ..... |        |       |         |
| 2. Coal, bony ..... | 0' 6 " |       |         |
| 3. Coal, head ..... | 0 6    |       |         |
| 4. Coal, good ..... | 2 1    |       |         |
| 5. Bone .....       | 0 0½   |       |         |
| 6. Coal .....       | 0 1½   |       |         |
| 7. Bone .....       | 0 0¼   |       |         |
| 8. Coal .....       | 0 3½   |       |         |
| 9. Bone .....       | 0 0½   |       |         |
| 10. Coal .....      | 4 8    | 8     | ¾       |
| 11. Shale, gray.    |        |       |         |

"Second sample collected for analysis from Nos. 4 to 10 inclusive, of section in No. 1 Butt off Main North A, by D. B. Reger."

### Jamison Coal & Coke Co. No. 8.—No. 31 on Map 11.

Located ¼ mile east of Underwood; Pittsburgh coal.

|                      |         | Feet. | Inches. |
|----------------------|---------|-------|---------|
| 1. Head coal .....   |         |       |         |
| 2. Coal .....        | 1' 10 " |       |         |
| 3. Bone .....        | 0 0⅝    |       |         |
| 4. Coal .....        | 0 5     |       |         |
| 5. Bone .....        | 0 1     |       |         |
| 6. Coal .....        | 4 0½    |       |         |
| 7. Bottom coal ..... | 0 5     | 6     | 10½     |
| 8. Shale, gray.      |         |       |         |

"Tidal elevation, 681', spirit level; principal office, Oliver Building, Pittsburgh, Pa.; daily capacity, 2000 tons; 80 laborers and 240 miners employed; compressed air haulage; used for gas, steam, cement burning and coke; shipped east; butts N. 77°, 30' W.; faces N. 12°, 30' E; greatest rise north; first sample collected for analysis from Nos. 2, 3, 4, 5 and 6 of section in Room No. 2, 13th Left Extension, off 2nd Right, off 3rd Left, by D. B. Reger; G. H. Musgrove, Chief Clerk, authority for data."

**Jamison Coal & Coke Co. No. 8.—No. 31 on Map II.**Located  $\frac{3}{4}$  mile east of Underwood; Pittsburgh coal.

|                    | Feet. |                 | Inches.           |
|--------------------|-------|-----------------|-------------------|
| 1. Head coal ..... |       |                 |                   |
| 2. Coal .....      | 1'    | 8 "             |                   |
| 3. Bone .....      | 0     | 0 $\frac{1}{4}$ |                   |
| 4. Coal .....      | 0     | 5               |                   |
| 5. Bone .....      | 0     | 1               |                   |
| 6. Coal .....      | 4     | 0               | 6 2 $\frac{3}{4}$ |
| 7. Bottom coal.    |       |                 |                   |

"Second sample collected for analysis from Nos. 2, 3, 4 and 6 of section in Main Heading above 17th Right by D. B. Reger."

This company operates a number of bee-hive coke ovens at this mine, the coal being washed before using. According to the general superintendent, the plant is still in the experimental stage and for that reason no sample was secured for analysis.

**Jamison Coal & Coke Co. No. 7.—No. 32 on Map II.**

Located 1 mile west of Barrackville; Pittsburgh coal.

|                      | Feet. |                 | Inches.           |
|----------------------|-------|-----------------|-------------------|
| 1. Head coal .....   |       |                 |                   |
| 2. Coal .....        | 2'    | 3 "             |                   |
| 3. Bone .....        | 0     | 0 $\frac{1}{4}$ |                   |
| 4. Coal .....        | 0     | 2 $\frac{1}{2}$ |                   |
| 5. Bone .....        | 0     | 1               |                   |
| 6. Coal .....        | 0     | 3               |                   |
| 7. Bone .....        | 0     | 0 $\frac{3}{4}$ |                   |
| 8. Coal .....        | 3     | 11              |                   |
| 9. Bottom coal ..... | 0     | 6               | 7 3 $\frac{1}{2}$ |
| 10. Shale, gray.     |       |                 |                   |

"Tidal elevation, 665', spirit level; principal office, Oliver Building, Pittsburgh, Pa.; daily capacity, 1200 tons; 75 laborers and 103 miners employed; compressed air haulage; used for gas and coke; shipped east; butts, N. 77°, 30' W.; faces, N. 12°, 30' E.; greatest rise, southeast; first sample collected from Nos. 2, 3, 4, 6, 7 and 8 in No. 2 Heading, Main South A, by D. B. Reger; G. H. Musgrove, Chief Clerk, authority for data."

**Jamison Coal & Coke Co. No. 7.—No. 32 on Map II.**

Located 1 mile west of Barrackville; Pittsburgh coal.

|                     | Feet. |     | Inches. |
|---------------------|-------|-----|---------|
| 1. Draw slate ..... |       |     |         |
| 2. Coal, head ..... | 1'    | 0 " |         |
| 3. Coal .....       | 2     | 8   |         |

|                  |        | Feet. | Inches         |
|------------------|--------|-------|----------------|
| 4. Bone          | .....0 | 0 1/2 |                |
| 5. Coal          | .....0 | 2 1/2 |                |
| 6. Bone          | .....0 | 0 1/2 |                |
| 7. Coal          | .....0 | 3     |                |
| 8. Bone          | .....0 | 1     |                |
| 9. Coal          | .....4 | 3     |                |
| 10. Bottom coal  | .....0 | 4     | ..... 3 10 1/2 |
|                  |        |       |                |
| 11. Shale, gray. |        |       |                |

"Second sample collected for analysis from Nos. 3, 4, 5, 6, 7, and 9 of section in No. 3 Heading, Main North A by D. B. Reger."

The Jamison Coal & Coke Company through its general manager, M. W. Head, has furnished the Survey the following table of analyses, made partly by its own chemist and partly furnished by customers. According to Mr. Head the samples were taken from cars and represent 7 1/2 feet of the coal seam. The table furnishes valuable data in Marion county where the coal lies under ground and where this company has developed a large mining industry for gas and by-product coking coal.

**Jamison Coal & Coke Company, Table of Analyses;  
Pittsburgh Coal.**

| Date.                                   | Mois. | V. M. | F. C. | Ash  | Sul. |
|---|-------|-------|-------|------|------|
| <b>Analyses made in our Laboratory:</b> |       |       |       |      |      |
| <b>Mine No. 7, 3/4 coal.</b>            |       |       |       |      |      |
| Sept. 11th                              | ..... | ..... | ..... | 7.05 | .80  |
| Sept. 15th                              | ..... | ..... | ..... | 5.61 | 1.24 |
| Sept. 20th                              | ..... | ..... | ..... | 5.04 | 1.23 |
| Sept. 30th                              | ..... | ..... | ..... | 5.75 | .96  |
| Oct. 12th                               | ..... | ..... | ..... | 7.65 | 1.04 |
| Oct. 30th                               | ..... | ..... | ..... | 5.45 | 1.28 |
| <b>Mine No. 8, 3/4 coal.</b>            |       |       |       |      |      |
| Sept. 11th                              | ..... | ..... | ..... | 5.65 | .84  |
| Sept. 14th                              | ..... | ..... | ..... | 5.57 | .69  |
| Sept. 14th                              | ..... | ..... | ..... | 5.11 | .96  |
| Nov. 16th                               | ..... | ..... | ..... | 5.95 | .84  |
| <b>Mine No. 8, Run of mine coal</b>     |       |       |       |      |      |
| Oct. 4th                                | ..... | ..... | ..... | 6.00 | .72  |
| Oct. 5th                                | ..... | ..... | ..... | 8.14 | .94  |
| Oct. 6th                                | ..... | ..... | ..... | 6.00 | 1.06 |
| Nov. 29th                               | ..... | ..... | ..... | 7.57 | .96  |
| Nov. 29th                               | ..... | ..... | ..... | 8.96 | 1.04 |



| Date.                                | Mols. | V. M. | F. C. | Ash  | Sul. |
|--------------------------------------|-------|-------|-------|------|------|
| <b>Mine No. 9, ¾ coal.</b>           |       |       |       |      |      |
| Sept. 14th .....                     | ..... | ..... | ..... | 6.89 | .94  |
| Sept. 14th .....                     | ..... | ..... | ..... | 4.74 | .92  |
| Dec. 21st. ....                      | ..... | ..... | ..... | 5.30 | .97  |
| <b>Mine No. 9, Run of Mine coal.</b> |       |       |       |      |      |
| Oct. 18th .....                      | ..... | ..... | ..... | 6.21 | 1.24 |
| Dec. 5th .....                       | ..... | ..... | ..... | 5.40 | 1.19 |
| <b>Analyses made by customers:</b>   |       |       |       |      |      |
| <b>Mine No. 7, ¾ coal</b>            |       |       |       |      |      |
| Nov. 20th .....                      | ..... | ..... | ..... | 5.77 | .94  |
| Nov. 14th .....                      | ..... | ..... | ..... | 7.63 | 1.04 |
| Nov. 6th .....                       | ..... | ..... | ..... | 6.60 | 1.18 |
| <b>Mine No. 8, ¾ coal.</b>           |       |       |       |      |      |
| Sept. 30th .....                     | ..... | ..... | ..... | 7.01 | .70  |
| Oct. 28th .....                      | ..... | ..... | ..... | 4.90 | .73  |
| Oct. 4th .....                       | 1.90  | 39.22 | 52.74 | 6.14 | .69  |
| Oct. 10th .....                      | 1.40  | 37.90 | 53.70 | 7.00 | .92  |
| <b>Mine No. 8, Run of mine coal.</b> |       |       |       |      |      |
| Feb. 14th .....                      | .77   | 36.53 | 54.60 | 8.10 | 1.02 |
| Mar. 1st .....                       | .70   | 35.80 | 55.10 | 8.40 | 1.15 |
| <b>Mine No. 9, ¾ coal.</b>           |       |       |       |      |      |
| Sept. 23rd. ....                     | ..... | ..... | ..... | 5.25 | .92  |
| Oct. 19th. ....                      | ..... | ..... | ..... | 5.70 | .80  |

**Consolidation Coal Co. No. 38 (Shaft Mine)—No. 33  
on Map II.**

Located at Barnstown Station, 1 mile north of Fairmont; Pittsburgh coal.

|                     | Feet. | Inches. |
|---------------------|-------|---------|
| 1. Draw slate ..... |       |         |
| 2. Coal, head ..... | 1' 6" |         |
| 3. Coal .....       | 1     | 8       |
| 4. Bone .....       | 0     | 0¾      |
| 5. Coal .....       | 0     | 2       |
| 6. Bone .....       | 0     | 0½      |
| 7. Coal .....       | 0     | 3       |
| 8. Bone .....       | 0     | 1       |
| 9. Coal .....       | 4     | 6       |
|                     |       | 8 3¾    |

10. Shale, gray.

"Tidal elevation, 756', spirit level; principal office, Fairmont: daily capacity, 600 tons; 134 laborers and 105 miners employed; rope and electric haulage; used for steam; shipped west; butts, N. 77°, 30' W.; faces, N. 12°, 30' E.; greatest rise, southeast; sample collected for analysis from Nos. 3, 4, 5, 6, 7 and 9 of section in Main Dip Air-course by D. B. Reger; J. J. Brennen, Supt., authority for data."

A former analysis of coal from this mine was published in Vol. II(A), W. Va. G. S., page 643.

**Pat Hoge Mine.—No. 34 on Map II.**

Located in Fairmont; Pittsburgh coal.

|                              |    |     | Feet. | Inches. |
|------------------------------|----|-----|-------|---------|
| 1. Coal, roof, left up ..... |    |     |       |         |
| 2. Coal .....                | 2' | 8 " |       |         |
| 3. Band, 1½" to .....        | 0  | 1   |       |         |
| 4. Coal .....                | 0  | 6   |       |         |
| 5. Band .....                | 0  | 0½  |       |         |
| 6. Coal .....                | 4  | 2   | 7     | 5½      |
| 7. Slate.                    |    |     |       |         |

"Principal office, Fairmont; daily capacity, 20 tons; 5 men employed; used for local domestic fuel; butts, N. 78° W.; faces, N. 12° E.; greatest rise, southeast; sample collected from mining section by Ray V. Hennen."

**Consolidation Coal Co. No. 56 (Gaston) No. 35 on Map II.**

Located at Gaston; Pittsburgh coal.

|                    |    |     | Feet. | Inches |
|--------------------|----|-----|-------|--------|
| 1. Head coal ..... |    |     |       |        |
| 2. Coal .....      | 2' | 1½" |       |        |
| 3. Bone .....      | 0  | 1   |       |        |
| 4. Coal .....      | 0  | 2   |       |        |
| 5. Bone .....      | 0  | 0¼  |       |        |
| 6. Coal .....      | 0  | 3½  |       |        |
| 7. Bone .....      | 0  | 0½  |       |        |
| 8. Coal .....      | 4  | 4   | 7     | 0¾     |
| 9. Shale, gray.    |    |     |       |        |

"Tidal elevation, 895', spirit level; principal office, Fairmont; daily capacity, 1000 tons; 105 laborers and 70 miners employed; electric and rope haulage; used for steam; shipped west; butts, N. 77° 30' W; faces, N. 12°, 30' E.; greatest rise, southeast; sample collected for analysis from Nos. 2, 4, 6, 7 and 8 in Room No. 20, First Butt off Second North by D. B. Reger; Harry Crane, Supt., authority for data."

A former analysis of coal from this mine was published in Vol. II(A), W. Va. G. S., page 643.

**Consolidation Coal Co. No. 26 (New England)—No. 36 on Map II.**

Located at New England; Pittsburgh coal.

|                     |    |      | Feet. | Inches. |
|---------------------|----|------|-------|---------|
| 1. Draw slate ..... |    |      |       |         |
| 2. Coal, head ..... | 0' | 10 " |       |         |
| 3. Coal .....       | 2  | 0½   |       |         |

|         |        |     | Feet. | Inches. |
|---------|--------|-----|-------|---------|
| 4. Bone | .....0 | ° 1 |       |         |
| 5. Coal | .....0 | 3   |       |         |
| 6. Bone | .....0 | 0½  |       |         |
| 7. Coal | .....0 | 3   |       |         |
| 8. Bone | .....0 | 0½  |       |         |
| 9. Coal | .....4 | 5½  | 8     | 0½      |

## 10. Shale, gray.

"Tidal elevation, 936', spirit level; principal office, Fairmont; daily capacity, 1200 tons; 75 laborers and 80 miners employed; electric haulage; used for steam and domestic fuel; shipped in all directions; butts, N. 77° 30' W.; faces, N. 12° 30' E.; greatest rise, southeast; sample collected for analysis from Nos. 3 to 9 inclusive of section in Main Dip. Heading by D. B. Reger; H. C. Ash, Supt., authority for data."

A former analysis of coal from this mine was published in Vol. II(A), W. Va. G. S., page 643.

## Robinson Bros., James Mine.—No. 37 on Map II.

Located 1½ miles northeast of Kingmont; Pittsburgh coal.

|               |         |     | Feet. | Inches. |
|---------------|---------|-----|-------|---------|
| 1. Draw slate | .....   |     |       |         |
| 2. Coal       | .....1' | 4 " |       |         |
| 3. Bone       | .....0  | 0½  |       |         |
| 4. Coal       | .....0  | 2½  |       |         |
| 5. Bone       | .....0  | 0½  |       |         |
| 6. Coal       | .....4  | 0   | 6     | 7       |

## 7. Shale, gray.

"Tidal elevation, 1097', hand level; principal office, Fairmont; mine just starting. (Nov. 25, 1911) and no tonnage developed; horse haulage; used for local domestic fuel; butts, N. 77° 30' W.; faces, N. 12° 30' E.; greatest rise, southeast; sample collected for analysis from Nos. 2, 3, 4, 5 and 6 of section in Main Heading, 300 feet underground, by D. B. Reger; J. C. McClay, foreman, authority for data."

Virginia & Pittsburgh Coal & Coke Co., Kingmont Mine.—  
No. 38 on Map II.

Located at Kingmont; Pittsburgh coal.

|              |         |     | Feet. | Inches. |
|--------------|---------|-----|-------|---------|
| 1. Head coal | .....   |     |       |         |
| 2. Coal      | .....2' | 2 " |       |         |
| 3. Bone      | .....0  | 0½  |       |         |
| 4. Coal      | .....0  | 6½  |       |         |
| 5. Bone      | .....0  | 1   |       |         |
| 6. Coal      | .....4  | 2   | 7     | 0½      |

## 7. Shale, gray.

"Tidal elevation, 964', hand level; principal office, Kingmont (Fairmont P. O.); daily capacity, 1000 tons; 124 laborers and 176 miners employed; rope and electric haulage; used for gas, by-product coke, and domestic fuel; shipped east; butts, N. 75° W.; faces, N. 15° E.; greatest rise, southeast; sample collected for analysis from Nos. 2, 3, 4 and 6 of section in No. 13 Butt Left by D. B. Reger; Samuel R. Hite, assistant treasurer, authority for data."

A former analysis of coal from this mine was published in Vol. II(A), W. Va. G. S., page 643.

This Company has 69 bee-hive coke ovens, of which 36 are in operation (Jan. 21, 1913). A sample of 72-hour coke collected here by Reger gives the following analysis, according to Hite and Krak.

|                       | Per Cent. |
|-----------------------|-----------|
| Moisture .....        | 0.04      |
| Volatile Matter ..... | 0.72      |
| Fixed Carbon .....    | 89.01     |
| Ash .....             | 10.23     |
| <hr/>                 |           |
| Total .....           | 100.00    |
| Sulphur .....         | 1.46      |
| Phosphorus .....      | 0.049     |

**Phillips Coal Co. Mine.—No. 39 on Map II.**

Located 1/2 mile west of Benton Ferry; Pittsburgh coal.

|                       | Feet. | Inches. |
|-----------------------|-------|---------|
| 1. Slate, black ..... |       |         |
| 2. Coal .....         | 3'    | 2 "     |
| 3. Bone .....         | 0     | 0 1/2   |
| 4. Coal .....         | 0     | 2 1/2   |
| 5. Bone .....         | 0     | 0 3/4   |
| 6. Coal .....         | 0     | 3       |
| 7. Bone .....         | 0     | 1       |
| 8. Coal .....         | 4     | 4 1/2   |
|                       | <hr/> |         |
| 9. Shale, gray.       |       |         |

"Tidal elevation, 1100'. Aneroid; principal office, Fairmont; daily capacity, 150 tons; 6 laborers and 14 miners employed; horse haulage and gravity cable across Tygart Valley river; used for steam; shipped north; butts, N. 77° 30' W.; faces, N. 12° 30' E.; greatest rise, southeast; sample collected for analysis from Nos. 2, 3, 4, 5, 6, and 8 of section in Room No. 2, Second Left Heading, by D. B. Reger; Russell Wilt, foreman authority for data."

**Consolidation Coal Co. No. 43 (Monongah No. 6)—No. 40  
on Map II.**

Located at Monongah; Pittsburgh coal.

|                       | Feet. Inches. |      |
|-----------------------|---------------|------|
| 1. Slate, black ..... |               |      |
| 2. Coal, bony .....   | 1' 0 "        |      |
| 3. Coal .....         | 2 7           |      |
| 4. Bone .....         | 0 0¼          |      |
| 5. Coal .....         | 0 2           |      |
| 6. Bone .....         | 0 0½          |      |
| 7. Coal .....         | 0 2½          |      |
| 8. Bone .....         | 0 0¼          |      |
| 9. Coal .....         | 4 1           | 8 2¼ |
| 10. Shale, gray.      |               |      |

"Tidal elevation, 829', spirit level; owned by J. N. Camden estate; principal office, Fairmont; daily capacity, 700 tons; 128 laborers and 100 miners employed; electric haulage; used for steam and domestic fuel; shipped east and west; butts N 71° 30' W; faces N 12° 30' E; greatest rise, southeast; sample collected for analysis from Nos. 3 to 9 inclusive of section in Room No. 13 of 6th Left off 2nd North by D. B. Reger; T. R. Barber, Supt., authority for data."

A former analysis of coal from this mine was published in Vol. II(A), W. Va. G. S., page 643.

**Consolidation Coal Co. No. 22 (Monongah No. 7)—No. 41  
on Map II.**

Located ¼ mile south of Monongah; Pittsburgh coal.

|                     | Feet. Inches. |      |
|---------------------|---------------|------|
| 1. Draw slate ..... |               |      |
| 2. Coal, head ..... | 0' 8 "        |      |
| 3. Coal .....       | 1 11          |      |
| 4. Bone .....       | 0 0½          |      |
| 5. Coal .....       | 0 2½          |      |
| 6. Bone .....       | 0 0½          |      |
| 7. Coal .....       | 0 3½          |      |
| 8. Bone .....       | 0 0¼          |      |
| 9. Coal .....       | 4 6½          | 7 9¼ |
| 10. Shale, gray.    |               |      |

"Tidal elevation, 859', spirit level; owned by J. N. Camden estate; principal office, Fairmont; tonnage and labor included under Monongah No. 5; electric haulage; used for steam; shipped east and west; butts, N 77° 30' W; faces, 12° 30' E; greatest rise, southeast; sample collected for analysis from Nos. 3 to 9 inclusive of section in Main Heading, by D. B. Reger; G. E. Peddicord, Supt., authority for data."

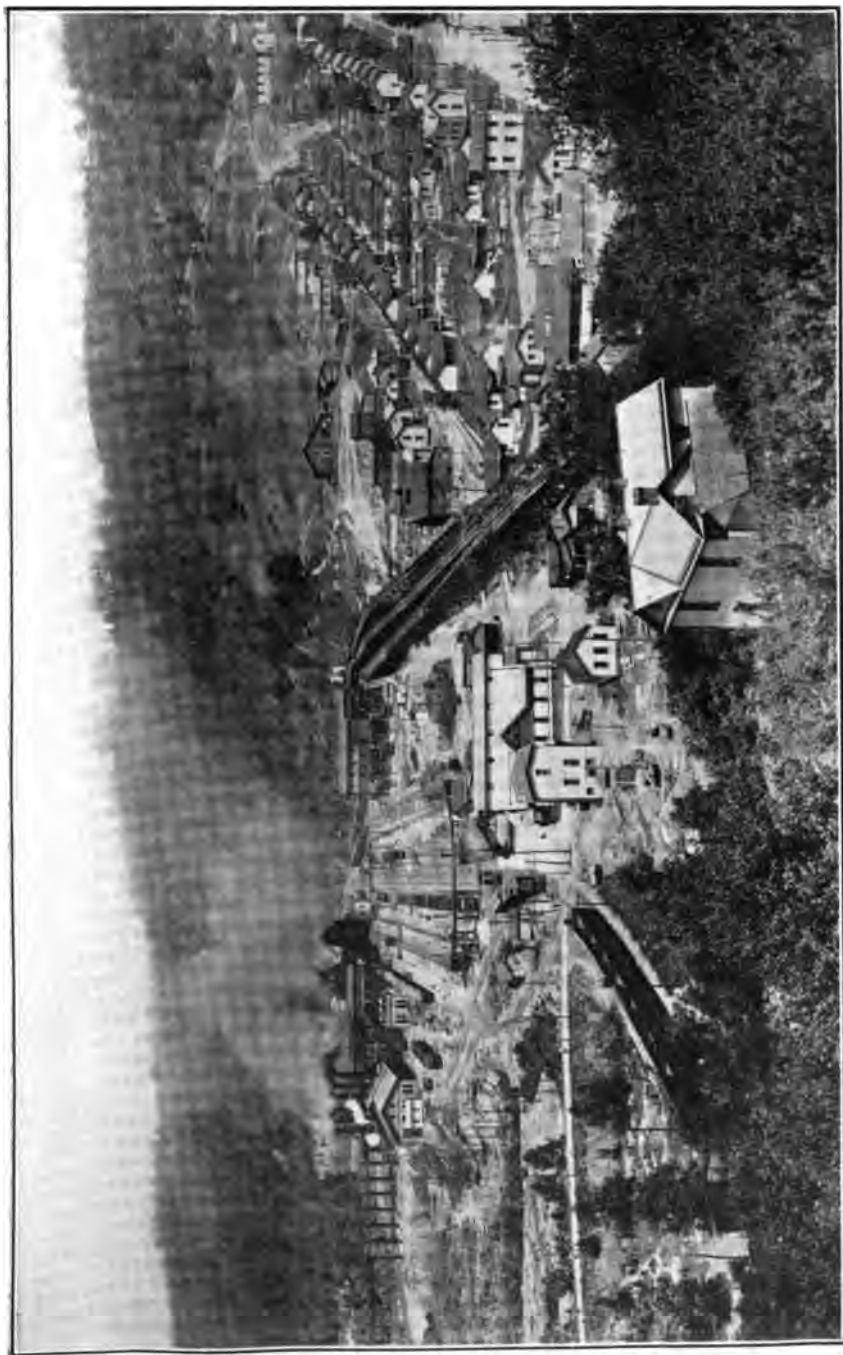


PLATE XXXI.—View of Monongah, Marlon County, showing coal handling plant of the Consolidation Coal Company. Topography of the Monongahela Series. The Waynesburg Sandstone at the base of the Dunkard shows at several points along the ridge.



**Consolidation Coal Co. No. 22 (Monongah No. 5)—No. 42  
on Map II.**

Located 1 mile southeast of Monongah; Pittsburgh coal.

|                          | Feet. |    | Inches. |     |
|--------------------------|-------|----|---------|-----|
| 1. Draw slate .....      |       |    |         |     |
| 2. Coal, head, bony..... | 0'    | 10 | "       |     |
| 3. Coal, good .....      | 2     | 3½ |         |     |
| 4. Bone .....            | 0     | 1  |         |     |
| 5. Coal .....            | 0     | 2½ |         |     |
| 6. Bone .....            | 0     | 0½ |         |     |
| 7. Coal .....            | 0     | 3  |         |     |
| 8. Bone .....            | 0     | 0¾ |         |     |
| 9. Coal, good .....      | 4     | 1  | 7       | 10¼ |

10. Shale, gray.

"Tidal elevation, 899', spirit level; owned by J. N. Camden estate; principal office, Fairmont; daily capacity, 700 tons; 25 laborers and 85 miners employed; electric haulage; used for steam; shipped east and west; butts, N 77° 30' W; faces, N 12° 30' E; greatest rise, southeast; sample collected for analysis from Nos. 3, 5, 7 and 9 of section in Room No. 5, Third Face off Second Left by D. B. Reger; G. E. Peddicord, Supt., authority for data."

**Consolidation Coal Co. No. 53 (Shaver Nos. 1 and 2)—No  
43 on Map II.**

Located 1½ miles southeast of Monongah; Pittsburgh coal.

|                      | Feet. |    | Inches. |    |
|----------------------|-------|----|---------|----|
| 1. Slate, black..... |       |    |         |    |
| 2. Bone coal.....    | 0'    | 2  | "       |    |
| 3. Coal .....        | 2     | 2  |         |    |
| 4. Bone .....        | 0     | 0½ |         |    |
| 5. Coal .....        | 0     | 2½ |         |    |
| 6. Bone .....        | 0     | 0½ |         |    |
| 7. Coal .....        | 0     | 3  |         |    |
| 8. Bone .....        | 0     | 0¾ |         |    |
| 9. Coal .....        | 4     | 5  | 7       | 4¼ |

10. Shale, gray.

"Tidal elevation, 964', spirit level; principal office, Fairmont; daily capacity, 600 tons; 40 laborers and 60 miners employed; electric haulage; used for steam; shipped east and west; butts, N 77° 30' W; faces, N 12° 30' E; greatest rise, southeast; sample collected for analysis from Nos. 3 to 9, inclusive, of section in No. 16 Pillar of First Left by D. B. Reger; mine foreman, authority for data."



**Consolidation Coal Co. No. 63 (Monongah No. 8)—No. 44  
on Map II.**

Located 1 mile southwest of Monongah; Pittsburgh coal.

|                      | Feet. | Inches. |   |    |
|----------------------|-------|---------|---|----|
| 1. Slate, black..... |       |         |   |    |
| 2. Coal, bony.....   | 0'    | 1 "     |   |    |
| 3. Coal.....         | 2     | 10      |   |    |
| 4. Bone.....         | 0     | 0½      |   |    |
| 5. Coal.....         | 0     | 2       |   |    |
| 6. Bone.....         | 0     | 0½      |   |    |
| 7. Coal.....         | 0     | 2½      |   |    |
| 8. Bone.....         | 0     | 0½      |   |    |
| 9. Coal.....         | 4     | 6       | 7 | 11 |
| <hr/>                |       |         |   |    |
| 10. Shale, gray.     |       |         |   |    |

"Tidal elevation, 892', spirit level; principal office, Fairmont; daily capacity, 700 tons; 70 laborers and 90 miners employed; electric haulage; used for steam and coke; shipped east and west; butts, N 77° 30' W; faces, N 12° 30' E; greatest rise, southeast; sample collected for analysis from Nos. 3 to 9, inclusive, of section in Room No. 5, No. 1 Left, Third North, by D. B. Reger; S. S. Davidson, foreman, authority for data."

The Consolidation Coal Company has 99 bee-hive coke ovens, making 4 tons of coke to the run, that use a considerable part of the product of Nos. 63 and 34 (Map Nos. 44 and 45). Samples were collected by Reger of both 48- and 72-hour coke, which show the following analyses, according to Hite and Krak.

|                     | 48-hour coke. | 72-hour coke. |
|---------------------|---------------|---------------|
|                     | Per cent.     | Per cent.     |
| Moisture.....       | 0.40          | 0.28          |
| Volatle Matter..... | 1.99          | 1.39          |
| Fixed Carbon.....   | 86.51         | 87.01         |
| Ash.....            | 11.10         | 11.32         |
| <hr/>               |               |               |
| Totals.....         | 100.00        | 100.00        |
| Sulphur.....        | 1.15          | 1.02          |
| Phosphorus.....     | 0.041         | 0.052         |

No loss on air drying in either sample.

**Consolidation Coal Co. No. 34 (Monongah No. 3)—No. 45  
on Map II.**

Located 1¼ miles southwest of Monongah; Pittsburgh coal.

|                     | Feet | Inches. |
|---------------------|------|---------|
| 1. Slate, dark..... |      |         |
| 2. Bone coal.....   | 0'   | 1 "     |
| 3. Coal.....        | 3    | 0       |

|         |        | Feet. | Inches.                  |
|---------|--------|-------|--------------------------|
| 4. Bone | .....0 | 0     | $\frac{3}{4}$            |
| 5. Coal | .....0 | 3     |                          |
| 6. Bone | .....0 | 0     | $\frac{3}{4}$            |
| 7. Coal | .....0 | 2     | $\frac{1}{2}$            |
| 8. Bone | .....0 | 0     | $\frac{1}{2}$            |
| 9. Coal | .....4 | 3     | ..... 7 11 $\frac{1}{2}$ |

10. Shale, gray.

"Tidal elevation, 896', spirit level; principal office, Fairmont; daily output, 250 tons; 30 laborers and 33 miners employed; electric haulage; used for coke, steam, gas and steel purposes; shipped in all directions; butts, N 77° 30' W; faces, N 12° 30' E; greatest rise, southeast; sample collected for analysis from Nos. 3 to 9 inclusive, of section in Chain Pillar of Sixth Left Heading, by D. B. Reger; J. B. Simons, outside foreman, authority for data."

A former analysis of coal from this mine was published in Vol II(A), W. Va. G. S., page 643. The coal shows a lower percentage of sulphur than any other Pittsburgh mine sampled by the Survey in Monongalia, Marion or Taylor counties.

**Consolidation Coal Co. No. 68 (Pennois)—No. 46 on Map II.**

Located at Everson; Pittsburgh coal.

|               |         | Feet. | Inches.                 |
|---------------|---------|-------|-------------------------|
| 1. Draw slate | .....   |       |                         |
| 2. Coal       | .....2' | 6     | "                       |
| 3. Bone       | .....0  | 0     | $\frac{1}{2}$           |
| 4. Coal       | .....0  | 2     | $\frac{1}{2}$           |
| 5. Bone       | .....0  | 0     | $\frac{1}{2}$           |
| 6. Coal       | .....0  | 2     | $\frac{1}{2}$           |
| 7. Bone       | .....0  | 0     | $\frac{1}{2}$           |
| 8. Coal       | .....4  | 6     | ..... 7 6 $\frac{1}{2}$ |

9. Shale, gray.

"Tidal elevation, 910', spirit level; principal office, Fairmont; daily capacity, 525 tons; 37 laborers and 75 miners employed; horse haulage; used for steam, coke and gas; shipped east and west; butts, N 77° 45' W; faces, N 12° 15' E; greatest rise, southeast; sample collected for analysis from Nos. 2 to 8, inclusive, of section in Main Heading between 6th and 7th Left Butt, by D. B. Reger; A. K. Parsons, foreman, authority for data."

A former analysis of coal from this mine was published in Vol. II(A), W. Va. G. S., page 643. This coal is very low in sulphur.

### Harry B. Clark Coal Co., Mine No. 6.—No. 47 on Map II.

Located  $\frac{3}{4}$  mile north of Kilarm; Pittsburgh coal.

|                         |                   | Feet. | Inches. |
|-------------------------|-------------------|-------|---------|
| 1. Slate, black.....    |                   |       |         |
| 2. Head coal, bony..... | 0' 6 "            |       |         |
| 3. Coal .....           | 2 3               |       |         |
| 4. Bone .....           | 0 0 $\frac{3}{4}$ |       |         |
| 5. Coal .....           | 0 2 $\frac{1}{2}$ |       |         |
| 6. Bone .....           | 0 0 $\frac{1}{2}$ |       |         |
| 7. Coal .....           | 0 3               |       |         |
| 8. Bone .....           | 0 0 $\frac{3}{4}$ |       |         |
| 9. Coal .....           | 4 0 $\frac{1}{2}$ | 7     | 5       |
| 10. Shale, gray.        |                   |       |         |

"Tidal elevation, 996', spirit level; principal office, Fairmont; daily capacity, 200 tons; 14 laborers and 25 miners employed; horse haulage; used for steam; shipped east; butts, N 77° 30' W; faces, N 12° 30' E; greatest rise, southeast; sample collected for analysis from Nos. 3, 4, 5, 6, 7 and 9 of section in Second Right Heading, by D. B. Reger; H. C. Sanders, foreman, authority for data."

### Harry B. Clark Coal Co., Mine No. 3.—No. 48 on Map II.

Located 1 mile north of Kilarm; Pittsburgh coal.

|                     |                   | Feet. | Inches.         |
|---------------------|-------------------|-------|-----------------|
| 1. Draw slate ..... |                   |       |                 |
| 2. Head coal.....   | 0' 6 "            |       |                 |
| 3. Coal .....       | 2 3 $\frac{1}{2}$ |       |                 |
| 4. Bone .....       | 0 0 $\frac{1}{2}$ |       |                 |
| 5. Coal .....       | 0 2               |       |                 |
| 6. Bone .....       | 0 0 $\frac{3}{4}$ |       |                 |
| 7. Coal .....       | 0 3               |       |                 |
| 8. Bone .....       | 0 1               |       |                 |
| 9. Coal .....       | 3 10              | 7     | 2 $\frac{3}{4}$ |
| 10. Shale, gray.    |                   |       |                 |

"Tidal elevation, 970'; aneroid; principal office, Fairmont; not in operation (Nov. 22, 1911); butts, N 77° 30' W; faces, N 12° 30' E; greatest rise, southeast; sample collected for analysis from Nos. 3, 4, 5, 6, 7 and 9 of section in Right Crosscut of Straight Heading by D. B. Reger; H. C. Sanders, foreman, authority for data."

### Harry B. Clark Coal Co., Mine No. 2.—No. 49 on Map II.

Located  $\frac{3}{4}$  mile north of Kilarm; Pittsburgh coal.

|                   |                      | Feet. | Inches. |
|-------------------|----------------------|-------|---------|
| 1. Bone coal..... |                      |       |         |
| 2. Coal .....     | 2' 2 $\frac{1}{2}$ " |       |         |
| 3. Bone .....     | 0 0 $\frac{3}{4}$    |       |         |
| 4. Coal .....     | 0 3                  |       |         |
| 5. Bone .....     | 0 0 $\frac{1}{2}$    |       |         |

|                |        |    | Feet.   | Inches |
|----------------|--------|----|---------|--------|
| 6. Coal        | .....0 | 3  |         |        |
| 7. Bone        | .....0 | 1  |         |        |
| 8. Coal        | .....1 | 11 |         |        |
| 9. Bottom coal | .....0 | 3  | ..... 5 | 0%     |

## 10. Shale, gray.

"Tidal elevation, 970', aneroid; principal office, Fairmont; daily capacity, 30 tons; 1 laborer and 5 miners employed; horse haulage; used for steam; shipped east; butts, N 77° 30' W; faces, N 12° 30' E; greatest rise, southeast; sample collected for analysis from Nos. 2, 3, 4, 5, 6 and 8 of section in slab on Main Heading; H. C. Sanders, foreman, authority for data."

## Kilarm Coal &amp; Coke Co., Mine No. 2.—No. 50 on Map II.

Located  $\frac{1}{8}$  mile north of Kilarm; Pittsburgh coal.

|               |         |     | Feet.   | Inches. |
|---------------|---------|-----|---------|---------|
| 1. Slate      | .....   |     |         |         |
| 2. Wild coal  | .....0' | 8 " |         |         |
| 3. Draw slate | .....0  | 10  |         |         |
| 4. Head coal  | .....1  | 3   |         |         |
| 5. Coal       | .....1  | 8   |         |         |
| 6. Bone       | .....0  | 1   |         |         |
| 7. Coal       | .....0  | 2½  |         |         |
| 8. Bone       | .....0  | 0%  |         |         |
| 9. Coal       | .....0  | 3½  |         |         |
| 10. Bone      | .....0  | 0½  |         |         |
| 11. Coal      | .....2  | 1½  | ..... 7 | 2%      |

## 12. Shale, gray.

"Tidal elevation, 980', aneroid; principal office, Kilarm; daily capacity, 250 tons; not in operation (Nov. 22, 1911); horse haulage; used for steam; shipped east and west; butts, N 80° 34' W; faces, N 9° 26' E; greatest rise, S 23° 30' E; sample collected for analysis from Nos. 5, 7, 9, 10 and 11 of section in Room No. 5, Second Left Heading, by D. B. Reger; C. E. Zeek, Supt., authority for data."

## Kilarm Coal &amp; Coke Co., Mine No. 1.—No. 51 on Map II.

Located  $\frac{1}{4}$  mile south of Kilarm; Pittsburgh coal.

|                 |         |     | Feet.   | Inches. |
|-----------------|---------|-----|---------|---------|
| 1. Slate, black | .....   |     |         |         |
| 2. Head coal    | .....1' | 3 " |         |         |
| 3. Coal         | .....1  | 8   |         |         |
| 4. Bone         | .....0  | 1   |         |         |
| 5. Coal         | .....0  | 2   |         |         |
| 6. Bone         | .....0  | 0½  |         |         |
| 7. Coal         | .....0  | 3   |         |         |
| 8. Bone         | .....0  | 0½  |         |         |
| 9. Coal         | .....4  | 2   | ..... 7 | 8       |

## 10. Shale.

"Tidal elevation, 1025', aneroid; principal office, Kilarm; daily capacity, 250 tons; not in operation (Nov. 22, 1911); electric haulage; used for steam; shipped east and west; butts, N 80° 34' W; faces, N 9° 26' E; greatest rise, S 23° 30' E; sample collected for analysis from Nos. 3 to 9, inclusive, of section in Second Right Heading by D. B. Reger; C. E. Zeek, Supt., authority for data."

This mine was not in operation, owing to the presence of an extensive shale horseback that in places cuts the coal down to a thickness of only 1½ feet. This feature is unusual, as no other mine in the Pittsburgh coal in the territory of this report contains anything like it.

### Consolidation Coal Co. No. 59 (Anderson)—No. 52 on Map II.

Located 0.1 mile north of Highland; Pittsburgh coal.

|                     | Feet.  | Inches. |
|---------------------|--------|---------|
| 1. Draw slate ..... |        |         |
| 2. Coal, bony ..... | 0' 3 " |         |
| 3. Coal .....       | 2 4½   |         |
| 4. Bone .....       | 0 1    |         |
| 5. Coal .....       | 0 2    |         |
| 6. Bone .....       | 0 0¾   |         |
| 7. Coal .....       | 0 4½   |         |
| 8. Bone .....       | 0 0¾   |         |
| 9. Coal .....       | 4 0    | 7 4½    |
| 10. Shale, gray.    |        |         |

"Tidal elevation, 930', spirit level; principal office, Fairmont; daily capacity, 150 tons; 9 laborers and 12 miners employed; electric haulage; used for steam; shipped east and west; butts, N 74° W; faces, N 16° E; greatest rise, southeast; sample collected for analysis from Nos. 3, 5, 7 and 9 of section in Second Right Heading, off Fourth Left Face, by D. B. Reger; Walter Neely, outside foreman, authority for data."

### Consolidation Coal Co. No. 36 (Highland)—No. 53 on Map II.

Located 0.1 mile south of Highland; Pittsburgh coal.

|                       | Feet.  | Inches. |
|-----------------------|--------|---------|
| 1. Slate, black ..... |        |         |
| 2. Wild coal .....    | 0' 8 " |         |
| 3. Draw slate .....   | 0 10   |         |
| 4. Head coal .....    | 0 10   |         |
| 5. Coal, good .....   | 1 10   |         |
| 6. Bone .....         | 0 1    |         |
| 7. Coal .....         | 0 3½   |         |
| 8. Bone .....         | 0 0½   |         |
| 9. Coal .....         | 0 3½   |         |

|                      |   |    | Feet. | Inches. |
|----------------------|---|----|-------|---------|
| 10. Bone .....       | 0 | 0% |       |         |
| 11. Coal, good ..... | 3 | 7  | 8     | 6¼      |

12. Shale, gray.

"Tidal elevation, 927'. aneroid; principal office, Fairmont; daily capacity, 1200 tons; 100 laborers and 90 miners employed; electric and mule haulage; used for steam; shipped east and west; headings run S 48° 48' E, quartering with the butts of the coal which are N 77° 30' W; faces N 12° 30' E; greatest rise, southeast; sample collected for analysis from Nos. 5, 7, 9 and 11 of section in Room No. 3, Fifth Left Heading, by D. B. Reger; Walter Neely, outside foreman, authority for data."

A former analysis of coal from this mine was published in Vol. II. (A), W. Va. G. S., page 643.

**Consolidation Coal Co. No. 47 (Middleton).—No. 54 on Map II.**

Located ½ mile south of Chiefton; Pittsburgh coal.

|                      |    |    | Feet. | Inches. |
|----------------------|----|----|-------|---------|
| 1. Wild coal.....    | 0' | 8  | "     |         |
| 2. Shale, gray ..... | 1  | 0  |       |         |
| 3. Coal, bony .....  | 0  | 5  |       |         |
| 4. Coal .....        | 2  | 6½ |       |         |
| 5. Bone .....        | 0  | 1  |       |         |
| 6. Coal .....        | 0  | 5  |       |         |
| 7. Bone .....        | 0  | 0% |       |         |
| 8. Coal .....        | 0  | 3½ |       |         |
| 9. Bone .....        | 0  | 0½ |       |         |
| 10. Coal .....       | 4  | 1½ | 9     | 7¾      |

11. Shale, gray.

"Tidal elevation, 925', spirit level; principal office, Fairmont, daily capacity, 600 tons; 60 laborers and 40 miners employed; electric and mule haulage; used for steam; shipped west; butts N 77° 30' W; faces N 12° 30' E; greatest rise southeast; sample collected from Nos. 4, 6, 7, 8, 9 and 10 of section, in Third Face Heading, by D. B. Reger; T. R. Reed, outside foreman, authority for data."

A former analysis of coal from this mine was published in Vol. II. (A), W. Va. G. S., page 643.

**Consolidation Coal Co. No. 28 (Chiefton)—No. 55 on Map II.**

Located at Chiefton; Pittsburgh coal.

|                            |    |   | Feet. | Inches. |
|----------------------------|----|---|-------|---------|
| 1. Sandstone, massive..... |    |   |       |         |
| 2. Shale, gray.....        |    |   | 1     | 2       |
| 3. Wild coal, slaty.....   | 1' | 3 | "     |         |
| 4. Shale, gray.....        | 0  | 5 |       |         |
| 5. Coal, bony.....         | 0  | 6 |       |         |

|     |      | Feet. |                 | Inches. |    |
|-----|------|-------|-----------------|---------|----|
| 6.  | Coal | 2     | 10              |         |    |
| 7.  | Bone | 0     | 0 $\frac{3}{4}$ |         |    |
| 8.  | Coal | 0     | 3               |         |    |
| 9.  | Bone | 0     | 0 $\frac{3}{4}$ |         |    |
| 10. | Coal | 0     | 3               |         |    |
| 11. | Bone | 0     | 0 $\frac{3}{4}$ |         |    |
| 12. | Coal | 4     | 2               | 9       | 10 |

## 13. Shale, gray

"Tidal elevaton, 896', spirit level; principal office, Fairmont; daily capacity, 700 tons; output, 375 tons; 50 laborers and 40 miners employed; electric haulage; used for steam and domestic fuel; shipped east and west; butts N 77° 30' W; faces N 12° 30' E; greatest rise northeast; sample collected for analysis from Nos. 6, 8, 10 and 12 of section in Room No. 9, No. 11 Left Heading, by D. B. Reger; U. S. Stafford, outside foreman, authority for data."

A former analysis of coal from this mine was published in Vol. II. (A), W. Va. G. S., page 643.

**Consolidation Coal Co. No. 84 (Paradise)—No. 56 on Map II.**

Located  $\frac{1}{4}$  mile north of Hutchinson; Pittsburgh coal.

|    |           | Feet. |                 | Inches. |                 |
|----|-----------|-------|-----------------|---------|-----------------|
| 1. | Head coal |       |                 |         |                 |
| 2. | Coal      | 1'    | 7 "             |         |                 |
| 3. | Bone      | 0     | 0 $\frac{3}{4}$ |         |                 |
| 4. | Coal      | 0     | 3               |         |                 |
| 5. | Bone      | 0     | 1               |         |                 |
| 6. | Coal      | 0     | 4               |         |                 |
| 7. | Bone      | 0     | 0 $\frac{3}{4}$ |         |                 |
| 8. | Coal      | 4     | 3               | 6       | 7 $\frac{1}{2}$ |

## 9. Slate, black.

"Tidal elevation, 836', spirit level; principal office, Fairmont; daily capacity, 100 tons; mine is just being opened (Nov. 13, 1911) and capacity will soon be much greater; 74 men employed; chain and horse haulage; used for steam; shipped east and west; greatest rise, southeast; sample collected for analysis from Nos. 2, 3, 4, 6 and 7 of section in North Airway No. 2, by D. B. Reger; K. D. Bailey, Supt., authority for data."

**Consolidation Coal Co. No. 67 (Hutchinson)—No. 57 on Map II.**

Located at Hutchinson; Pittsburgh coal.

|    |                    | Feet. |      | Inches |  |
|----|--------------------|-------|------|--------|--|
| 1. | Sandstone, massive |       |      |        |  |
| 2. | Wild coal          | 0'    | 10 " |        |  |
| 3. | Slate, gray, 0" to | 1     | 3    |        |  |
| 4. | Head coal          | 1     | 0    |        |  |
| 5. | Coal               | 1     | 5    |        |  |

|               |   | Feet. | Inches. |
|---------------|---|-------|---------|
| 6. Bone ..... | 0 | 0½    |         |
| 7. Coal ..... | 0 | 7     |         |
| 8. Bone ..... | 0 | 0¾    |         |
| 9. Coal ..... | 4 | 4     | 9 6¼    |

10. Shale, gray.

"Total elevation, 865', spirit level; principal office, Fairmont; daily capacity, 500 tons; 40 laborers and 45 miners employed; horse haulage to foot of slope; used for steam; shipped west; butts, N 77° 30' W; faces, N 12° 30' E; greatest rise, southeast; sample collected from Nos. 5 to 9, inclusive, of section, in Room No. 10, 5th Butt Entry, by D. B. Reger; K. D. Bailey, Supt., authority for data."

A former analysis of coal from this mine was published in Vol. II. (A), W. Va. G. S., page 643.

The Four States Coal & Coke Company has recently begun the operation of a large tract of low sulphur coal in Lincoln district, Marion county. Owing to the isolation of the mine, being the most western operation in the territory of this report, three separate samples were taken. The coal in this region is about 300 feet below drainage and is reached by shafting.

**Four States Coal & Coke Co., Annabelle No. 1 Mine—No. 58 on Map II.**

Located at Annabelle; Pittsburgh coal.

|                     |    | Feet. | Inches. |
|---------------------|----|-------|---------|
| 1. Head coal.....   |    |       |         |
| 2. Coal .....       | 1' | 9     | "       |
| 3. Bone .....       | 0  | 0¾    |         |
| 4. Coal .....       | 0  | 7     |         |
| 5. Bone .....       | 0  | 1     |         |
| 6. Coal .....       | 4  | 0     |         |
| 7. Bottom coal..... | 0  | 4     | 6 9¾    |

8. Shale, gray.

"Tidal elevation, 746', spirit level; principal office, Frick Bldg., Pittsburgh, Pa.; daily capacity, 1800 tons; 75 laborers and 200 miners employed; compressed air haulage; used for steam, gas, coke and domestic purposes; shipped east and west; butts N 78° W; faces, N 12° E; greatest rise, S 54° E; first sample collected from Nos. 2, 3, 4 and 6 of section in No. 2 Butt East, Left Rise, by D. B. Reger; E. F. Miller, Supt., authority for data."



**Four States Coal & Coke Co., Annabelle No. 1 Mine—No. 58  
on Map II.**

Located at Annabelle; **Pittsburgh, coal.**

|                      | Feet. | Inches. |
|----------------------|-------|---------|
| 1. Slate, black..... |       |         |
| 2. Head coal.....    | 1'    | 0 "     |
| 3. Coal .....        | 0     | 11      |
| 4. Bone .....        | 0     | 0½      |
| 5. Coal .....        | 0     | 7       |
| 6. Bone .....        | 0     | 1       |
| 7. Coal .....        | 4     | 4       |
| 8. Bottom coal.....  | 0     | 4       |
|                      | 7     | 3½      |
| 9. Shale, gray.      |       |         |

Second sample collected from Nos. 3, 4, 5, 6 and 7 in Room No. 5, No. 1 Butt East, by D. B. Reger.

**Four States Coal & Coke Co., Annabelle No. 1 Mine—No. 58  
on Map II.**

Located at Annabelle; **Pittsburgh coal.**

|                     | Feet. | Inches. |
|---------------------|-------|---------|
| 1. Head coal.....   |       |         |
| 2. Coal .....       | 2'    | 2½"     |
| 3. Bone .....       | 0     | 0½      |
| 4. Coal .....       | 0     | 2       |
| 5. Bone .....       | 0     | 0¼      |
| 6. Coal .....       | 0     | 4       |
| 7. Bone .....       | 0     | 0¾      |
| 8. Coal .....       | 4     | 3       |
| 9. Bottom coal..... | 0     | 6       |
|                     | 7     | 7       |

10. Shale, gray.

"Third sample collected from Nos. 2, 3, 4, 5, 6 and 8 of section in Left Main Dip Aircourse by D. B. Reger."

Lying in the Ligonier Syncline and entirely separated from the coal of the Monongahela Valley by the Chestnut Ridge Anticline, from the summit of which the Monongahela series has been eroded, is a large body of Pittsburgh coal in Taylor county. The coal in this basin has some marked difference from that of the Monongahela Valley. At the top there is usually only 2 to 3 inches of slaty coal that is perceptibly different from the rest of the seam. This feature makes it desirable to mine it almost to the draw slate instead of leaving a foot of coal in place for the roof, as is done along the Monongahela. The bands of bone at the middle of the seam are not regarded with such disfavor as they are elsewhere, and are often shipped with the remainder of the coal.

The following sections illustrate the bed section of this coal in the Ligonier basin of Taylor county:

**Harrison Coal Co., Tyrconnel Mine—No. 59 on Map II.**

Located  $\frac{1}{2}$  mile south of Rosemont; Pittsburgh coal.

|                            | Feet. | Inches. |
|----------------------------|-------|---------|
| 1. Sandstone, massive..... |       |         |
| 2. Coal, slaty.....        | 0'    | 2"      |
| 3. Coal .....              | 2     | 10      |
| 4. Bone .....              | 0     | 1       |
| 5. Coal, good.....         | 4     | 8       |
|                            | <hr/> |         |
|                            | 7     | 9       |

6. Shale, gray, hard.

"Tidal elevation, 1331', hand level; principal office, Meyersdale, Pa., daily capacity, 200 tons; 40 men employed; mule haulage; used for steam and domestic fuel; shipped east and west; butts, N 85° W; faces, N 5° E; greatest rise, northwest; sample collected from Nos. 3, 4 and 5 in Room No. 1, Straight Fairmont Heading, by D. B. Reger; H. G. Smith, Supt., authority for data."

A former analysis of coal from this mine was published in Vol. II. (A), W. Va. G. S., page 644.

**Rosemont Coal Co., Rosemont Mine—No. 60 on Map II.**

Located  $\frac{1}{2}$  mile southeast of Rosemont; Pittsburgh coal.

|                             | Feet. | Inches. |
|-----------------------------|-------|---------|
| 1. Sandstone, massive ..... |       |         |
| 2. Coal, slaty.....         | 0'    | 3 "     |
| 3. Coal .....               | 2     | 6       |
| 4. Bone .....               | 0     | 0%      |
| 5. Coal .....               | 4     | 1       |
|                             | <hr/> |         |
|                             | 6     | 10%     |

"Tidal elevation, 1280', hand level; principal office, Philadelphia, Pa.; daily capacity, 900 tons; 250 men employed; electric and horse haulage; used for steam and domestic fuel; shipped east and west; butts, N 78° 45' W; faces, N 11° 15' E; greatest rise, northwest; sample collected for analysis from Nos. 3, 4 and 5 of section in Room No. 22, B-3 Heading, by D. B. Reger; James Stafford, Supt., authority for data."

A former analysis of coal from this mine was published in Vol. II. (A), W. Va. G. S., page 644.

**Pittsvein Coal Co., Flemington Mine—No. 61 on Map II.**

Located  $\frac{1}{2}$  mile northeast of Flemington; Pittsburgh coal.

|                             |   |    | Feet. | Inches. |
|-----------------------------|---|----|-------|---------|
| 1. Slate, black, hard ..... |   |    |       |         |
| 2. Draw slate.....          |   | 1  |       | 0       |
| 3. Coal, slaty.....         | 0 | 3  |       |         |
| 4. Coal .....               | 2 | 2  |       |         |
| 5. Bone .....               | 0 | 1½ |       |         |
| 6. Coal .....               | 0 | 6½ |       |         |
| 7. Bone .....               | 0 | 1½ |       |         |
| 8. Coal .....               | 4 | 6  | 7     | 8½      |

9. Shale, gray.

"Tidal elevation, 1205', hand level; principal office, Flemington; daily capacity, 500 tons; 110 men employed; electric haulage; used for steam and domestic fuel; shipped east and west; butts, N. 80°, W.; faces, N. 10° E.; coal rises to northwest and southeast; sample collected from Nos. 4 to 8 inclusive, of section in Room No. 33, First Left Heading, by D. B. Reger; I. D. Martin, Chief Clerk, authority for data."

A former analysis of coal from this mine was published in Vol. II (A), W. Va. G. S., page 644.

**T. B. Davis Coal Co., T. B. Davis Mine—No. 62 on Map II.**

Located  $\frac{1}{2}$  mile southeast of Flemington. Pittsburgh coal.

|                      |    |    | Feet. | Inches. |
|----------------------|----|----|-------|---------|
| 1. Black slate ..... |    |    |       |         |
| 2. Shale, gray ..... |    | 1  |       | 0       |
| 3. Slate .....       |    | 0  |       | 6       |
| 4. Coal, slaty ..... | 0' | 3  |       |         |
| 5. Coal .....        | 2  | 7  |       |         |
| 6. Bone .....        | 0  | 1  |       |         |
| 7. Coal .....        | 4  | 6  |       |         |
| 8. Slate, gray ..... | 0  | 0½ |       |         |
| 9. Coal .....        | 0  | 5  | 7     | 10½     |

10. Shale, gray.

"Tidal elevation, 1187', hand level; principal office, Piedmont; daily capacity, 250 tons; 55 men employed; rope haulage; used for steam and domestic fuel; shipped east and west; butts, N. 84° W.; faces, N. 6° E.; greatest rise, northeast; sample collected for analysis from Nos. 5, 6 and 7 of section in Main Heading of new mine by D. B. Reger; W. B. Wolf, Supt., authority for data."

A former analysis of coal from this mine was published in Vol. II (A), W. Va. G. S., page 644.

**McGraw Coal Co., New York Mine—No. 63 on Map II.**

Located  $\frac{3}{4}$  mile southwest of Simpson; **Pittsburgh coal.**

|                       |    |     | Feet. Inches. |   |
|-----------------------|----|-----|---------------|---|
| 1. Slate, black ..... |    |     |               |   |
| 2. Coal .....         | 2' | 4 " |               |   |
| 3. Bone .....         | 0  | 1   |               |   |
| 4. Coal .....         | 4  | 8   | 7             | 1 |

5. Shale, gray.

"Tidal elevation, 1305', hand level; principal office, Frostburg, Md.; daily capacity, 700 tons; 70 men employed; electric haulage; used for steam and domestic fuel; shipped east and west; butts, N. 78° W.; faces N. 12° E.; greatest rise, southeast; sample collected for analysis from Nos. 2, 3 and 4 of section in Fifth Butt Entry by D. B. Reger; C. C. Lovett, Supt., authority for data."

A former analysis of coal from this mine was published in Vol. II. (A), W. Va., G. S., page 644.

**Grafton Coal & Coke Co., Sand Lick Mine—No. 64 on Map II.**

Located 1 mile northwest of Simpson; **Pittsburgh coal.**

|                       |    |     | Feet. Inches. |   |
|-----------------------|----|-----|---------------|---|
| 1. Slate, black ..... |    |     |               |   |
| 2. Coal, bony .....   | 0' | 2 " |               |   |
| 3. Coal .....         | 1  | 8   |               |   |
| 4. Bone .....         | 0  | 0½  |               |   |
| 5. Coal .....         | 0  | 6   |               |   |
| 6. Bone .....         | 0  | 1   |               |   |
| 7. Coal .....         | 4  | 2   | 6             | 7 |
| 8. Shale, gray        |    |     |               |   |

"Tidal elevation, 1248', hand level; principal office, Grafton; daily capacity, 500 tons; 150 men employed; horse haulage; used for steam and domestic fuel; shipped east and west; butts, N. 82° W.; faces, N. 8° E.; greatest rise, southeast; sample collected for analysis from Nos. 3 to 7, inclusive, of section in Room No. 4, Straight Heading, by D. B. Reger; H. A. Fahey, Supt., authority for data."

A former analysis of coal from this mine was published in Vol. II (A), W. Va. G. S., page 644.

The Maryland Coal Company of West Virginia has extensive operations at Wendel on Sand Lick Run in the trough of the Ligonier Syncline. There are several openings, all close together and all using the same tittle.

Maryland Coal Co. of W. Va., Wendel No. 4 Mine—No. 65  
on Map II.

Located at Wendel (Simpson P. O.); Pittsburgh coal.

|  | Feet. | Inches.         |
|--|-------|-----------------|
| 1. Sandstone, massive .....              |       |                 |
| 2. Slate, black, checkered at base ..... | 4     | 0               |
| 3. Draw slate, 0" to .....               | 1     | 8               |
| 4. Coal, slaty .....0' 2 "               |       |                 |
| 5. Coal .....2 1                         |       |                 |
| 6. Bone .....0 1                         |       |                 |
| 7. Coal .....0 6                         |       |                 |
| 8. Bone .....0 0 $\frac{1}{4}$           |       |                 |
| 9. Coal .....3 11                        | 6     | 9 $\frac{1}{4}$ |

10. Shale, gray.

"Tidal elevation, 1214.2', spirit level; principal office, No. 1 Broadway, New York City; daily capacity of Wendel Nos. 1, 4 and 5, 1500 tons; Nos. 1, 2 and 3 are connected and operated together; all five use the same tippie; 240 men employed; electric haulage; used for steam and domestic fuel; shipped east and west; butts, N. 77° 40' W.; faces, N. 12° 20' E.; greatest rise, southeast; sample collected for analysis from Nos. 5 to 9, inclusive, of section in Room No. 7, Second Left Heading, by D. B. Reger; E. R. Clayton, Supt., authority for data."

Maryland Coal Co. of W. Va., Wendel No. 1 Mine—No. 66  
on Map II.

Located at Wendel; Pittsburgh coal.

|                                | Feet. | Inches.         |
|--------------------------------|-------|-----------------|
| 1. Draw slate .....            |       |                 |
| 2. Slate, black .....          | 0     | 0 $\frac{1}{4}$ |
| 3. Coal .....1' 2 "            |       |                 |
| 4. Bone .....0 1 $\frac{1}{4}$ |       |                 |
| 5. Coal .....0 7               |       |                 |
| 6. Bone .....0 1               |       |                 |
| 7. Coal, good .....3 8         | 5     | 7 $\frac{1}{4}$ |

8. Shale, gray.

"Tidal elevation, 1235.1', spirit level; principal office, No. 1 Broadway, New York City; for capacity and labor see Wendel No. 4; electric haulage; used for steam and domestic fuel; shipped east and west; butts N. 77° 40' W.; faces N. 12° 20' E.; greatest rise, north-west; sample collected for analysis from Nos. 3, 5 and 7 of section in Room No. 10, Pool Heading, by D. B. Reger; E. R. Clayton, Supt., authority for data."

Maryland Coal Co. of W. Va., Wendel No. 5 Mine— No. 67  
on Map II.

Located  $\frac{1}{2}$  mile north of Wendel; Pittsburgh coal.

|                                | Feet. | Inches. |
|--------------------------------|-------|---------|
| 1. Draw slate .....            |       |         |
| 2. Coal, good .....0' 9 "      |       |         |
| 3. Bone .....0 0 $\frac{1}{4}$ |       |         |

|                     |     | Feet. | Inches. |
|---------------------|-----|-------|---------|
| 4. Coal, good ..... | 4 9 | 5     | 6½      |

5. Shale, gray.

"Tidal elevation, 1253.7', spirit level; principal office, No. 1 Broadway, New York City; for capacity and labor see Wendel No. 4; west; butts N. 77° 40' W.; faces, N. 12° 20' E.; greatest rise, north-west; sample collected for analysis from Nos. 2, 3 and 4 of section in Room No. 3, First Left Heading, by D. B. Reger; E. R. Clayton, Supt., authority for data."

**John L. Robinson, Kunst Mine—No. 68 on Map II.**

Located ½ mile southwest of Pruntytown; Pittsburgh coal.

|                              |         | Feet. | Inches. |
|------------------------------|---------|-------|---------|
| 1. Slate, black, about ..... |         | 4     | 0       |
| 2. Wild coal, slaty .....    | 0' 10 " |       |         |
| 3. Slate, gray .....         | 0 4     |       |         |
| 4. Coal .....                | 2 0     |       |         |
| 5. Bone .....                | 0 1     |       |         |
| 6. Coal .....                | 4 2     | 7     | 5       |

7. Shale, gray.

"Tidal elevation, 1303' hand level; principal office, Pruntytown; mine owned by Kunst and operated by John L. Robinson; daily capacity, 20 tons; 1 laborer and 3 miners employed; horse haulage; used for steam and domestic fuel; hauled by wagon to Pruntytown and Fetterman; butts, N. 75° W.; faces, N. 15° E.; greatest rise, northeast; sample collected for analysis from Nos. 4, 5 and 6 of section by D. B. Reger; wild coal is left for the roof, but often falls soon after the coal below it is mined; John L. Robinson, operator, authority for data."

This mine does not ship coal by rail, but there is a fine local market at Pruntytown. In this mine the typical roof coal, lying above the draw slate, first described by J. J. Stevenson in Report K, Second Geological Survey of Penna., and later by I. C. White in Vol. II., W. Va. G. S., appears in this section. In this region it is known as the "wild coal."

Through the courtesy of C. McC. Lemley of the B. & O. Railroad, several samples of Pittsburgh coal, taken in Monongalia and Marion counties, were furnished the Survey. The following mines are reported, the analyses being grouped at the end of the sections:

**Antler Coal Company.**

Located at Round Bottom; Pittsburgh coal.

|                             |        | Feet. | Inches. |
|-----------------------------|--------|-------|---------|
| 0. Sandstone roof .....     |        |       |         |
| 1. Roof coal, 2'0" to ..... | 1' 0 " |       |         |
| 2. Draw slate .....         | 1 0    |       |         |

|    |                            |        | Feet. | Inches.         |
|----|----------------------------|--------|-------|-----------------|
| 3. | Coal                       | .....1 | 8     | $\frac{1}{2}$   |
| 4. | Bone                       | .....0 | 1     |                 |
| 5. | Coal                       | .....1 | 8     |                 |
| 6. | Bone, 0 $\frac{1}{2}$ " to | .....0 | 0     | $\frac{1}{4}$   |
| 7. | Coal                       | .....4 | 1     | $\frac{1}{2}$   |
| 8. | Sulphur band               | .....0 | 0     | $\frac{1}{8}$   |
| 9. | Coal                       | .....0 | 5     |                 |
|    |                            |        | 10    | 0 $\frac{3}{8}$ |

## 10. Fire clay.

"Sample collected for analysis from Nos. 3, 5, 6, 7 and 9 of section, about 1300' in mine, by J. C. Hellig and R. C. Tucker."

**Harvey Fisher, Farm Mine, Pittsburgh Coal.**

Located on Brand run,  $\frac{1}{2}$  mile northwest of Round Bottom.

|     |                |         | Feet. | Inches.         |
|-----|----------------|---------|-------|-----------------|
| 0.  | Sandstone      | .....   |       |                 |
| 1.  | Roof coal      | .....1' | 3     | "               |
| 2.  | Coal           | .....2  | 3     |                 |
| 3.  | Parting        | .....0  | 0     | $\frac{1}{8}$   |
| 4.  | Coal           | .....1  | 5     |                 |
| 5.  | Parting        | .....0  | 0     | $\frac{1}{8}$   |
| 6.  | Coal           | .....0  | 6     |                 |
| 7.  | Parting        | .....0  | 0     | $\frac{1}{2}$   |
| 8.  | Coal           | .....0  | 10    |                 |
| 9.  | Parting        | .....0  | 0     | $\frac{1}{4}$   |
| 10. | Coal           | .....1  | 11    |                 |
| 11. | Parting, 1" to | .....0  | 0     | $\frac{1}{2}$   |
| 12. | Coal           | .....1  | 10    |                 |
|     |                |         | 10    | 1 $\frac{7}{8}$ |

## 13. Fire clay.

"Tidal elevation, 1100', aneroid; butts, N. 78° W.; faces, N. 12° E.; greatest rise, southeast; sample collected for analysis from Nos. 2 to 10 inclusive, and No. 12 of section, 100' in mine, by J. C. Hellig and R. C. Tucker."

**Brock Farm Mine.**

Located at Flickersville; Pittsburgh coal.

|    |                 |         | Feet. | Inches.          |
|----|-----------------|---------|-------|------------------|
| 0. | Sandstone, roof | .....   |       |                  |
| 1. | Coal            | .....1' | 7     | "                |
| 2. | Slate           | .....0  | 0     | $\frac{1}{2}$    |
| 3. | Coal            | .....0  | 5     |                  |
| 4. | Parting         | .....0  | 0     | $\frac{1}{8}$    |
| 5. | Coal            | .....1  | 0     |                  |
| 6. | Parting         | .....0  | 0     | $\frac{1}{2}$    |
| 7. | Coal            | .....2  | 3     |                  |
| 8. | Sulphur parting | .....0  | 0     | $\frac{1}{8}$    |
| 9. | Coal            | .....1  | 6     |                  |
|    |                 |         | 6     | 10 $\frac{1}{4}$ |

## 10. Fire clay.

"Tidal elevation, 990', aneroid; butts, N. 78° W.; faces, N. 12° E.; greatest rise, northeast; sample collected for analysis from Nos. 1, 3, 4, 5, 7 and 9 of section, 150 feet in mine at last working face, by J. C. Hellig and R. C. Tucker."

**Alfred Hood, Farm Mine.**

Located on Indian Creek,  $\frac{3}{4}$  mile northwest of Opekiska; Pittsburgh coal.

|   | Feet. Inches      |                   |
|---|-------------------|-------------------|
| 0. Sandstone roof .....                       |                   |                   |
| 1. Roof coal .....                            | 2' 0 "            |                   |
| 2. Slate .....                                | 0 0 $\frac{1}{2}$ |                   |
| 3. Coal .....                                 | 1 3               |                   |
| 4. Bone .....                                 | 0 0 $\frac{3}{8}$ |                   |
| 5. Coal .....                                 | 0 7               |                   |
| 6. Bone .....                                 | 0 0 $\frac{1}{4}$ |                   |
| 7. Coal .....                                 | 0 9               |                   |
| 8. Slate .....                                | 0 0 $\frac{1}{2}$ |                   |
| 9. Coal .....                                 | 2 6               |                   |
| 10. Talc or soapstone parting,<br>0" to ..... | 0 2               |                   |
| 11. Coal .....                                | 0 2               |                   |
| 12. Sulphur band, 0" to.....                  | 0 2               |                   |
| 13. Coal .....                                | 1 0               | 8 8 $\frac{5}{8}$ |

14. Fire clay bottom.  
 "Tidal elevation, 960', aneroid; butts, N. 72° W.; faces, N. 18° E.; greatest rise, northeast; sample collected from Nos. 3, 5, 7, 9, 11 and 13 of section by J. C. Heilig and R. C. Tucker. Mining 6'3" at present. Sulphur band often contains sulphur balls 3" to 6" in diameter and a foot long. Looks like a fragment of a tree with sulphur filling the pores."

**Virginia and Pittsburgh Coal & Coke Co., Morgan Mine—  
No. 25 on Map II.**

Located  $\frac{1}{2}$  mile east of Montana; Pittsburgh coal.

|   | Feet. Inches      |                   |
|---|-------------------|-------------------|
| 0. Sandstone roof .....                     |                   |                   |
| 1. Roof coal, not taken out..               | 2' 0 "            |                   |
| 2. Coal .....                               | 0 8 $\frac{1}{2}$ |                   |
| 3. Parting, 0" to .....                     | 0 0 $\frac{1}{2}$ |                   |
| 4. Coal .....                               | 1 4               |                   |
| 5. Slate parting .....                      | 0 0 $\frac{1}{2}$ |                   |
| 6. Coal .....                               | 0 3               |                   |
| 7. Parting, 0" to .....                     | 0 0 $\frac{1}{2}$ |                   |
| 8. Coal .....                               | 0 3               |                   |
| 9. Slate, 0" to .....                       | 0 0 $\frac{1}{2}$ |                   |
| 10. Coal .....                              | 2 0               |                   |
| 11. Sulphur band, 0 $\frac{1}{8}$ " to..... | 0 0 $\frac{1}{4}$ |                   |
| 12. Coal .....                              | 0 6               |                   |
| 13. Fire clay streak, 0" to....             | 0 0 $\frac{1}{2}$ |                   |
| 14. Coal .....                              | 0 7               |                   |
| 15. Parting, contains some<br>sulphur ..... | 0 0 $\frac{1}{4}$ |                   |
| 16. Bottom coal .....                       | 0 7               | 8 5 $\frac{1}{2}$ |

17. Fire clay.  
 "Sample collected from Nos. 4, 6, 8, 10, 12, 14 and 16 of section by J. C. Heilig and R. C. Tucker."



### B. & O. Railroad Table of Coal Analyses—Pittsburgh Coal.

Chemical Work by J. B. Krak.

| Mine.                                    | Mois. | V. M. | F. C. | Ash.  | Sul. | Phos. |
|--|-------|-------|-------|-------|------|-------|
| Antler Coal Co .....                     | 0.95  | 34.75 | 56.89 | 7.41  | 1.72 | 0.010 |
| Harvey Fisher Farm ....                  | 1.09  | 34.85 | 57.13 | 6.93  | 1.74 | 0.006 |
| Brock Farm.....                          | 0.79  | 34.27 | 54.84 | 10.10 | 2.36 | 0.007 |
| Alfred Hood Farm .....                   | 2.04  | 32.98 | 58.26 | 6.72  | 1.58 | 0.008 |
| Va. & Pgh. C. & C. Co.<br>(Morgan) ..... | 1.34  | 34.70 | 59.68 | 4.28  | 1.11 | 0.017 |
| Average .....                            | 1.24  | 34.31 | 57.36 | 7.09  | 1.70 | 0.010 |

Messrs. Heilig and Tucker have used great care in noting small slate and sulphur partings in their measured sections and have discarded them from the samples. Since a slate parting less than  $\frac{1}{4}$  inch thick cannot, as a rule, be discarded on the dump, the analyses in the above table show a lower percentage of ash and sulphur than would likely be obtained from samples taken from the car.

### Quantity of Pittsburgh Coal Available.

Sufficient information was obtained from the mines and from oil wells to warrant the statement that the Pittsburgh coal is generally present with a thickness of at least 7 feet in the entire region where it is indicated on Map II. With area by Reger the following estimate is made:

### Amount of Pittsburgh Coal.

| Counties by Districts | Sq. Miles     | Acres          | Cubic Feet of Coal    | Short Tons of Coal   |
|-----------------------|---------------|----------------|-----------------------|----------------------|
| <b>Monongalia</b>     |               |                |                       |                      |
| Battelle .....        | 56.40         | 36,096         | 10,936,392,320        | 437,455,693          |
| Clay .....            | 63.49         | 40,634         | 12,389,319,280        | 495,572,771          |
| Cass .....            | 29.66         | 18,982         | 5,787,991,440         | 231,519,658          |
| Grant .....           | 34.45         | 22,048         | 6,722,876,160         | 268,915,046          |
| Union .....           | 8.22          | 5,261          | 1,604,184,120         | 64,167,365           |
| Morgan .....          | 1.21          | 774            | 236,008,080           | 9,440,323            |
| Clinton .....         | 0.01          | 6              | 1,829,520             | 73,181               |
| <b>Totals .....</b>   | <b>193.44</b> | <b>123,801</b> | <b>37,678,600,920</b> | <b>1,507,144,037</b> |

| Counties by Districts       | Sq. Miles     | Acres          | Cubic Feet of Coal    | Short Tons of Coal   |
|-----------------------------|---------------|----------------|-----------------------|----------------------|
| <b>Marion</b>               |               |                |                       |                      |
| Mannington .....            | 100.09        | 64,058         | 19,532,565,360        | 781,302,614          |
| Pawpaw .....                | 39.01         | 24,966         | 7,682,632,720         | 307,305,809          |
| Lincoln .....               | 56.42         | 36,109         | 11,010,356,280        | 440,414,251          |
| Fairmont .....              | 19.81         | 12,678         | 3,865,775,760         | 154,631,030          |
| Grant .....                 | 13.68         | 8,755          | 2,669,574,600         | 106,782,984          |
| Winfield .....              | 3.29          | 2,106          | 642,161,520           | 25,686,461           |
| Union .....                 | 1.02          | 653            | 199,182,760           | 7,987,310            |
| Totals .....                | 233.32        | 149.325        | 45,602,249,000        | 1,824,089,959        |
| <b>Taylor</b>               |               |                |                       |                      |
| Booths Creek ....           | 0.43          | 275            | 83,853,000            | 3,354,104            |
| Flemington .....            | 6.94          | 4,442          | 1,354,454,640         | 54,178,186           |
| Courthouse .....            | 6.73          | 4,307          | 1,313,290,440         | 52,531,618           |
| Totals .....                | 14.10         | 9,024          | 2,751,598,080         | 110,063,908          |
| <b>Totals for Area ....</b> | <b>440.86</b> | <b>282,150</b> | <b>86,032,448,000</b> | <b>3,441,297,904</b> |

Approximately 65,000,000 tons of coal have been mined from the three counties. This would leave a balance available of 3,376,000,000 short tons. Of this amount 90 to 95 per cent may be recovered by skilful mining.

### MINABLE COALS OF THE CONEMAUGH SERIES.

The coals of the Conemaugh Series, which have been described in detail in Chapter VII., are too thin and irregular to be considered for commercial mining. As outlined in Chapter VII., the Elk Lick, Harlem, Bakerstown and Brush Creek coals all have been mined to a considerable extent for domestic fuel at points where the thicker coals of the Monongahela and Allegheny Series are not available. They will prove to be of considerable value in such localities. Their distribution and thickness are too variable for an intelligent estimate of their tonnage to be made.

### MINABLE COALS OF THE ALLEGHENY SERIES.

#### The Upper Freeport Coal.

The Upper Freeport coal, described in Chapter VIII., stands next in importance after the Pittsburgh coal in the present state of the mining industry. It has been mined extensively in the Deckers creek valley, where its thickness

and uniformly low sulphur content make it unusually valuable. In the work of preparing this report a large number of both commercial and farm mines were examined. The coal was sampled by members of the Survey at all the commercial mines and at several farm mines in Monongalia and Taylor counties. In the portion of Marion county where the coal crops it has not been used to any large extent because the Lower Kittanning coal in the same region is thicker and more easily available. The coal was not sampled in Marion county owing to the lack of favorable opportunity. Nine mines, the sections of which follow in the text, were sampled. The analyses from these mines are published in the Table of Coal Analyses at the end of this chapter under their mine numbers.

#### Chess Estate, Farm Mine—No. 73 on Map II.

Located 0.6 mile northeast of Ices Ferry; Upper Freeport coal.

|                                |        |     | Feet. | Inches. |
|--------------------------------|--------|-----|-------|---------|
| 1. Coal, bony, roof, reported. | 2'     | 0 " |       |         |
| 2. Coal                        | .....2 | 10  |       |         |
| 3. Slate, gray                 | .....0 | 3   |       |         |
| 4. Coal                        | .....0 | 3   | ..... | 5 4     |
| 5. Slate, gray, pavement.      |        |     |       |         |

Sample collected from No. 2 of section.

It will be noted that the coal in this locality does not show the typical thickness of the bottom coal, as this member, No. 4 of section, is only 3 inches thick.

#### Elkins Coal & Coke Co. No. 1, Richard Mine—No. 74 on Map II.

Located  $\frac{1}{4}$  mile northeast of Richard; Upper Freeport coal.

|                          |         |     | Feet. | Inches. |
|--------------------------|---------|-----|-------|---------|
| 1. Sandstone, Mahoning   | .....   |     |       |         |
| 2. Coal, cannel slate    | .....2' | 4 " |       |         |
| 3. Coal, bony            | .....1  | 1   |       |         |
| 4. Coal, soft            | .....2  | 10  |       |         |
| 5. Slate, blue           | .....0  | 2   |       |         |
| 6. Coal, soft            | .....1  | 0   |       |         |
| 7. Fire clay shale, soft | .....0  | 4   |       |         |
| 8. Coal                  | .....0  | 1   |       |         |
| 9. Fire clay and rock    | .....4  | 7   |       |         |
| 10. Coal                 | .....1  | 0   | ..... | 13 5    |



"Elevation, 980', aneroid; greatest rise, S. 57° E.; about 8 per cent; mine capacity, 400 tons; men employed, 450; coal coked on the premises; sample taken for analysis from Nos. 4 and 6 of section by Ray V. Hennen." A sample was also collected from the cannel slate, No. 2.

### Connellsville Basin Coke Co.—No. 75 on Map II.

Located at Richard; Upper Freeport coal.

|   | Feet. | Inches |
|---|-------|--------|
| 1. Slate, thickness not exposed .....         |       |        |
| 2. Cannel slate, some bone<br>at bottom ..... | 3'    | 5 "    |
| 3. Coal, cannel, better<br>than (2) .....     | 1     | 3      |
| 4. Coal, bony, 6" to .....                    | 0     | 8      |
| 5. Coal, soft .....                           | 2     | 8      |
| 6. Slate, blue .....                          | 0     | 1      |
| 7. Coal, soft .....                           | 2     | 0      |
|   | 10    | 0      |

8. Fire clay, thickness not exposed.

"Tidal elevation, 980', aneroid; greatest rise, S. 76° E.; mine capacity, 300 tons; coal coked on premises; sample collected for analysis from Nos. 5 and 7 by Ray V. Hennen."

Just north of Dellslow station there is a small mine, recently opened, which furnished the coal for steam purposes on the Morgantown and Kingwood Railroad. This mine is known as the **Elkins Coal & Coke Co. No. 3, M. & K. Coalng Station**. Its section is published along with the Dellslow section in Chapter VIII. No sample was taken.

### Terence Stewart Farm Mine—No. 76 on Map II.

Located on Booth creek, 1.5 miles northwest of Clinton Furnace; Upper Freeport coal.

|   | Feet. | Inches. |
|---|-------|---------|
| 1. Shale, black .....                         |       |         |
| 2. Shale, gray, with streaks<br>of coal ..... | 2'    | 0 "     |
| 3. Coal, good .....                           | 2     | 1       |
| 4. Slate .....                                | 0     | 2       |
| 5. Coal, hard, bony .....                     | 0     | 9       |
|   | 5     | 0       |

6. Shale, gray.

Sample collected for analysis from No. 3 of section by D. B. Reger.

East of Clinton Furnace, on Toms run, the coal is only 3 feet thick as it is approaching the western limit of its

minable area. In the vicinity of Ridgedale and Clinton Furnace, however, it is much thicker, as the two following sections will show:

**Baldwin Weaver, Farm Mine—No. 77 on Map II.**

Located 1 mile south of Ridgedale; Upper Freeport coal.

|   | Feet. | Inches. |       |     |
|---|-------|---------|-------|-----|
| 1. Shale .....                                |       |         |       |     |
| 2. Coal, soft .....                           | 1     | 0       | "     |     |
| 3. Shale, gray, with streaks<br>of coal ..... | 0     | 9       |       |     |
| 4. Coal, good .....                           | 2     | 9       |       |     |
| 5. Shale, gray .....                          | 0     | 2       |       |     |
| 6. Coal, good .....                           | 1     | 0       | ..... | 5 8 |
| 7. Fire clay.                                 |       |         |       |     |

"Tidal elevation, 1680', aneroid; No. 2 of section is not mined but is left for roof, along with No. 3; sample collected for analysis from Nos. 4 and 6, by D. B. Reger."

**O. C. Johnson, Farm Mine—No. 78 on Map II.**

Located ¼ mile northeast of Clinton Furnace, Upper Freeport coal.

|                      | Feet. | Inches. |       |     |
|----------------------|-------|---------|-------|-----|
| 1. Shale, dark.....  |       |         |       |     |
| 2. Coal, good.....   | 0     | 10½"    |       |     |
| 3. Slate .....       | 0     | 0½"     |       |     |
| 4. Coal, good .....  | 1     | 0       |       |     |
| 5. Slate, bony ..... | 0     | 3       |       |     |
| 6. Coal, good .....  | 2     | 6       |       |     |
| 7. Shale, gray ..... | 0     | 3       |       |     |
| 8. Coal, good .....  | 0     | 9       | ..... | 5 8 |
| 9. Shale.            |       |         |       |     |

Sample collected for analysis from Nos. 2, 3, 4, 6 and 8 of section by D. B. Reger.

The coal is mined on White Day creek, near the Marion county line, where the following section was measured:

**Daniel Morris, Farm Mine—No. 79 on Map II.**

Located 0.7 mile northwest of Anita; Upper Freeport coal.

|                            | Feet. | Inches. |       |     |
|----------------------------|-------|---------|-------|-----|
| 1. Shale, gray .....       | 1     | 0       |       |     |
| 2. Slate, black .....      | 0     | 1       |       |     |
| 3. Coal, medium hard ..... | 1     | 9       | "     |     |
| 4. Slate, black .....      | 0     | 2       |       |     |
| 5. Coal, soft .....        | 1     | 3       | ..... | 3 2 |
| 6. Shale.                  |       |         |       |     |

Sample collected for analysis from Nos. 3 and 5 of section by D. B. Reger.

South of Thornton, Taylor county, the coal has been mined and found to have a good thickness. The following is a typical section:

### U. G. Jennings, Farm Mine—No. 80 on Map II.

Located 0.7 mile southeast of Thornton; Upper Freeport coal.

|                                      | Feet. | Inches |
|--------------------------------------|-------|--------|
| 1. Sandstone, massive, Mahoning..... | 30    | 0      |
| 2. Slate, black.....                 | 3     | 0      |
| 3. Coal, bony.....                   | 1' 0  | "      |
| 4. Coal, soft, good.....             | 2     | 10     |
| 5. Slate, gray.....                  | 0     | 1½     |
| 6. Coal, good.....                   | 1     | 1      |
| 7. Band.....                         | 0     | 0¼     |
| 8. Coal.....                         | 0 1   | 5 1¾   |

9. Fire clay, Bolivar..... 10 0

Sample collected for analysis from Nos. 4, 6, 7 and 8 of section by D. B. Reger.

In the extreme southeastern corner of Taylor county the coal has been mined and has the following section:

### Edith J. Harvey, Farm Mine—No. 81 on Map II.

|                          | Feet. | Inches |
|--------------------------|-------|--------|
| 1. Black slate.....      |       |        |
| 2. Coal, bony.....       | 0' 3  | "      |
| 3. Coal.....             | 2     | 6      |
| 4. Slate, dark gray..... | 0     | 2      |
| 5. Coal.....             | 0 11½ | 3 10½  |

6. Fire clay.

Sample collected for analysis from Nos. 3 and 5 of section by Ray V. Hennen.

### Quantity of Upper Freeport Coal Available.

As outlined in Figure 9, the Upper Freeport coal of commercial thickness and regularity is confined to a long strip of territory in the eastern part of the area. West of the Monongahela river the coal does not occur in appreciable quantity, since as a rule it is not recorded in wells. A few wells at Maidsville, Monongalia county, note its presence,

but as others in the same locality did not find it, hence it must be regarded as too irregular to be available. In the neighborhood of Pruntytown, Taylor county, it is recorded in several wells, but the information is too meager to consider its occurrence extensive enough to warrant mining operations. The following table will show the wells that record its occurrence:

List of Wells Recording Upper Freeport Coal.

|      | NAME OF WELL                                  | LOCATION                         | Elevation<br>of Well<br>Mouth<br>A. T. | Depth<br>Feet | Thickness<br>Feet. |
|------|---|----------------------------------|--|---------------|--------------------|
|      | <b>Monongalia County:</b>                     |                                  |  |               |                    |
| 277  | James Sanders No. 1.                          | Maldsville .....                 |  | 488           | 6                  |
| 320  | McClaren core test...                         | VanVoorhis, 1 m. S.              | 935B                                   | 318.6         | 1.2                |
| 320A | Jos. and David Krepps<br>No. 1 .....          | Morgantown, 1.5 m.<br>NW .....   | 808L                                   | 214           | 5                  |
| 321A | Wayne Wilson No. 1..                          | VanVoorhis, 1 m. S.              | 925B                                   | 335           | 5                  |
| 322  | VanVoorhis core test<br>No. 3 .....           | VanVoorhis .....                 | 810L                                   | 212.3         | 0.5                |
| 322A | Wayne Wilson No. 1..                          | VanVoorhis, 1 m. SE.             |  | 335           | 5                  |
| 333  | Am. Sheet & T. P. Co.<br>core test No. 3..... | Sabraton .....                   | 841L                                   | 248           | 4                  |
| 334  | Am. Sheet & T. P. Co.<br>core test No. 5..... | Sabraton, 0.4 m. N..             | 875L                                   | 279           | 5                  |
|      | <b>Marlon County:</b>                         |                                  |  |               |                    |
| 687  | W. R. Jasper Heirs<br>No. 1 .....             | Colfax .....                     | 926L                                   | 75            | 5                  |
| 688A | Edwin Nuzum No. 2504                          | Hammond, 0.8 m. NW               |  | 152           | 3                  |
|      | <b>Taylor County:</b>                         |                                  |  |               |                    |
| 694A | James Riley No. 1....                         | Hepzibah, 0.2 m. NW              |  | 370           | 8                  |
| 700  | Harrison Jones Heirs<br>No. 1 .....           | Pruntytown, 1.1 m.<br>NW .....   | 1205B                                  | 285           | 3                  |
| 700A | Henry Swindler No. 1.                         | Pruntytown, 1.1 m.<br>NW .....   |  | 450           | 10                 |
| 701  | Harrison Jones Heirs<br>No. 2 .....           | Pruntytown, 0.5 m.<br>NW .....   | 1272L                                  | 530           | 5                  |
| 703  | Hugh Evans No. 2....                          | Pruntytown, 2 m. S<br>75° W..... | 1101L                                  | 215           | 3                  |
| 704A | T. A. Gawthroy No. 1.                         | Pruntytown, 2 m. S<br>W .....    |  | 324           | 4                  |
| 711  | John B. Cather No. 1.                         | Flemington, 1.9 m.<br>NW .....   | 1140B                                  | 420           | 4                  |
| 725  | E. E. McDaniel core<br>test .....             | Stonehouse, 0.7 m.<br>NE .....   | 1105B                                  | 28            | 1.2                |



A careful study of all the information obtained in the field shows that the Upper Freeport coal, in the region outlined in Figure 9, varies greatly in thickness, but probably 3 feet would represent its average thickness better than any other figure. This thickness has been used by Reger in the following estimate of the quantity available. The area was measured by planimeter. The amount of coal already mined is too small to make any deduction necessary on that account.

### Available Upper Freeport Coal.

| Counties by Districts. | Square Miles. | Acres.   | Cubic Feet of Coal. | Short Tons of Coal. |
|------------------------|---------------|----------|---------------------|---------------------|
| <b>Monongalia</b>      |               |          |                     |                     |
| Grant .....            | 1.17          | 748.8    | 97,853,184          | 3,914,127           |
| Union .....            | 14.75         | 9,440.0  | 1,233,619,200       | 49,344,768          |
| Morgan .....           | 12.25         | 7,840.0  | 1,024,531,200       | 40,981,248          |
| Clinton .....          | 25.25         | 16,160.0 | 2,111,788,800       | 84,471,552          |
| Totals.....            | 53.42         | 34,188.8 | 4,467,792,384       | 178,711,695         |
| <b>Marion</b>          |               |          |                     |                     |
| Winfield .....         | 17.02         | 10,892.8 | 1,423,471,104       | 56,938,844          |
| Union .....            | 0.99          | 633.6    | 82,798,848          | 3,311,954           |
| Totals.....            | 18.01         | 11,526.4 | 1,506,269,952       | 60,250,798          |
| <b>Taylor</b>          |               |          |                     |                     |
| Fetterman .....        | 30.14         | 19,289.6 | 2,520,764,928       | 100,830,597         |
| Knottsville .....      | 5.29          | 3,385.6  | 442,430,208         | 17,697,208          |
| Totals.....            | 35.43         | 22,675.2 | 2,963,195,136       | 118,527,805         |
| Totals for Area...     | 106.86        | 68,390.4 | 8,937,257,472       | 357,490,298         |

### The Upper Kittanning Coai.

The Upper Kittanning coal, described in detail in Chapter VIII., has received but little attention as a mining proposition, but its wide distribution and good quality make it a valuable resource. It has been mined commercially in Taylor county along the Tygart Valley river. The mine is not in operation, but it was examined and sampled. The mine section is given below and the analysis is published in the Table of Coal Analyses at the end of this chapter under the mine number.

#### Winona Coal & Coke Co. No. 1 Mine—No. 84 on Map II.

Located at Coffman (Grafton R. F. D.); Upper Kittanning coal.

|                                  | Feet. Inches |   |
|----------------------------------|--------------|---|
| 1. Sandstone, massive.....       |              |   |
| 2. Slate, black.....             | 0            | 2 |
| 3. Coal, good.....2' 10"         |              |   |
| 4. Shale, gray.....0 1           |              |   |
| 5. Coal, good.....0 9            | 3            | 8 |
| 6. Fire clay, gray, visible..... | 2            | 6 |

"Tidal elevation, 1073', hand level; principal office, Ruffs Dale, Pa.; not in operation (Nov. 23, 1911); butts, N 78° W; faces, N 12° E; greatest rise, northwest; sample collected from Nos. 3 and 5 of section in Main Heading by D. B. Rege; F. D. Tarr, Supt., authority for data."

#### Quantity of Upper Kittanning Coal Available.

A large number of openings, examined at outcrop, show the Upper Kittanning coal to be 3 feet or less in thickness. The well records which note its presence make it much greater, as shown by the following table:

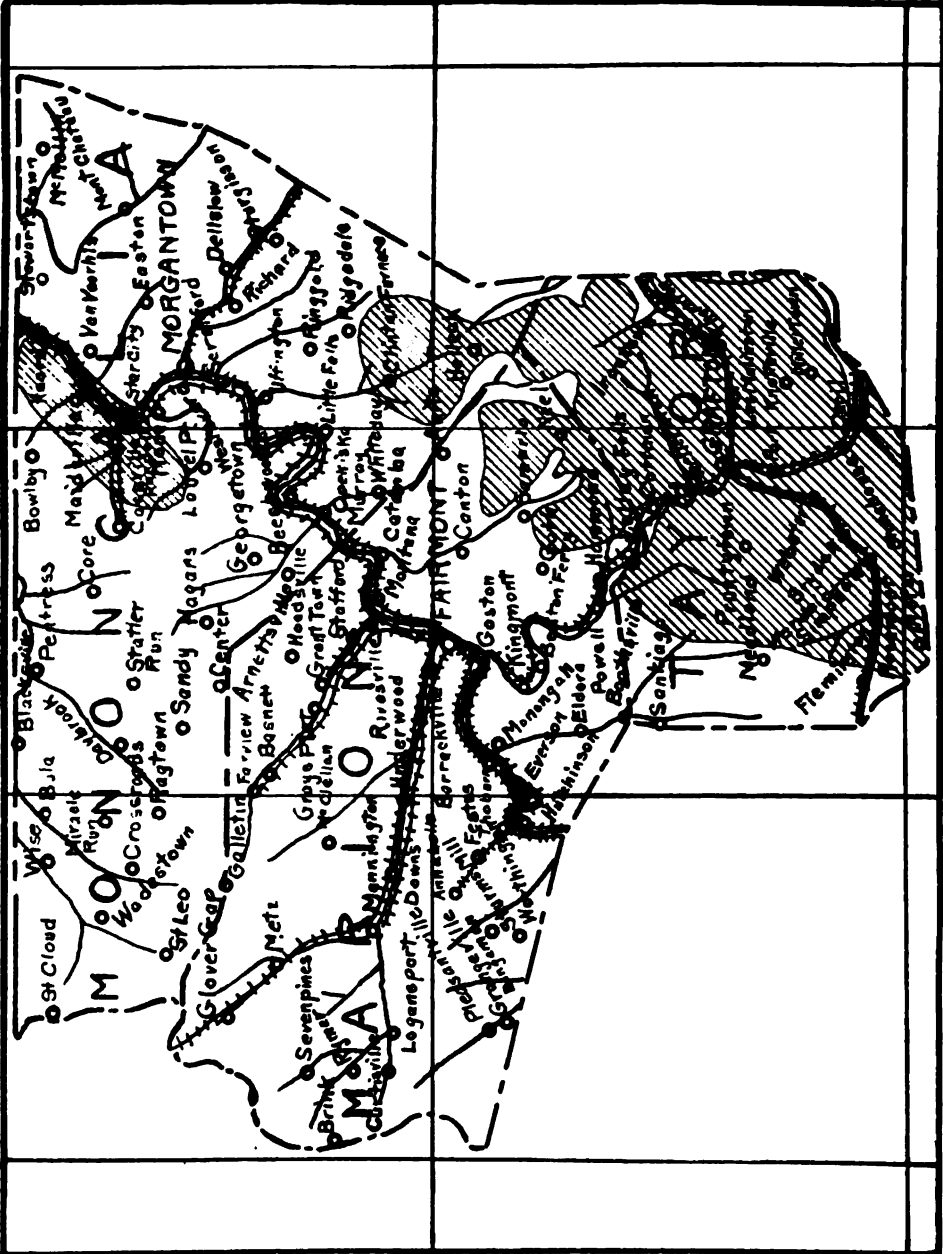


Figure 10.—Showing approximate area of Upper Kittanning Coal.

## List of Wells Recording Upper Kittanning Coal.

| No on Map                 | NAME OF WELL                                  | LOCATION                           | Elevation of Well | Depth. | Thickness |
|---------------------------|---|------------------------------------|-------------------|--------|-----------|
|                           |   |                                    | Month             |        |           |
| <b>Monongalia County:</b> |   |                                    |                   |        |           |
| 272                       | John Laird No. 1.....                         | Maldsville, 1.4 m. SW              | 1135B             | 971    | 5         |
| 273                       | Elza Davis No. 1.....                         | Maldsville, 1.1 m. W.              | 1050B             | 880    | 5         |
| 274                       | Wm. H. Smith No. 1..                          | Cassville, 1.1 m. W..              | 1155B             | 998    | 5         |
| 275                       | E. H. Clevenger No. 1.                        | Maldsville, 1.2 m. N<br>W .....    | 1170B             | 1045   | 5         |
| 277                       | James Sanders No. 1.                          | Maldsville .....                   |                   | 601    | 6         |
| 279                       | Jasper Stone No. 1...                         | Maldsville, 1 m. NW.               | 895B              | 705    | .....     |
| 280                       | M. G. Murphy No. 2...                         | Maldsville, 1.2 m. N<br>W .....    | 910B              | 727    | 4         |
| 281                       | Peter Lazzell No. 1...                        | Maldsville, 1.3 m. N<br>W .....    | 1170B             | 933    | 6         |
| 283                       | T. A. and J. F. Keenan<br>No. 1 .....         | Maldsville, 1.2 m. N<br>50° W..... | 1035B             | 837    | 3         |
| 290                       | Sanford Barrickman<br>No. 1 .....             | Cassville, 1.8 m. SE               | 1085B             | 986    | 5         |
| 321A                      | Wayne Wilson No. 1..                          | VanVoorhis, 1 m. S..               | 925B              | 416    | 4         |
| 322                       | VanVoorhis core test<br>No. 3 .....           | VanVoorhis .....                   | 810L              | 300.3  | 3.8       |
| 326                       | Francis Costolo No. 1.                        | Cheat Haven, 1.4 m. S              | 808L              | 375    | 3         |
| 332                       | Snyder No. 1.....                             | Morgantown .....                   | 808L              | 220    | 4         |
| 333                       | Am. Sheet & T. P. Co.<br>core test No. 3..... | Sabraton .....                     | 841L              | 364.5  | 1.8       |
| 334                       | Am. Sheet & T. P. Co.<br>core test No. 5..... | Sabraton, 0.4 m. N..               | 875L              | 402.7  | 2.8       |
| <b>Taylor County:</b>     |   |                                    |                   |        |           |
| 694A                      | James Riley No. 1....                         | Hepzibah, 0.2 m. NW                | .....             | 470    | 8         |
| 697                       | Martha Tucker No. 1..                         | Valley Falls, 1 m. S<br>10° W..... | 1080B             | 16     | 4         |
| 700                       | Harrison Jones Heirs<br>No. 1 .....           | Pruntytown, 1.1 m.<br>NW .....     | 1205B             | 385    | 7         |
| 700A                      | Henry Swindler No. 1.                         | Pruntytown, 1.1 m.<br>NW .....     | .....             | 588    | 6         |
| 701                       | Harrison Jones Heirs<br>No. 2 .....           | Pruntytown, 0.5 m.<br>NW .....     | 1272L             | 640    | 5         |
| 703                       | Hugh Evans No. 2....                          | Pruntytown, 2 m. S<br>75° W.....   | 1101L             | 340    | 5         |
| 711                       | John B. Cather No. 1.                         | Flemington, 1.9 m.<br>NW .....     | 1140B             | 527    | 8         |
| 715                       | Sarah E. Whitescarver<br>No. 1 .....          | Pruntytown, 2.4 m.<br>SW .....     | 1115B             | 500    | 6         |
| 715A                      | Clare F. Shafer No. 1.                        | Pruntytown, 2.4 m.<br>SW .....     | 1240B             | 735    | 3         |
| 718                       | M. Rector No. 1.....                          | Grafton, 2 m. SW...                | 985L              | 196    | 8         |
| 719                       | A. J. Bartlett core test                      | Webster .....                      | 1006L             | 217    | 4.8       |
| 724                       | E. H. Bennett core test<br>No. 2.....         | Stonehouse, 0.2 m. N               | 1022L             | 90     | 2         |

It must not be taken for granted that the large body of coal shown by Figure 10 in Taylor county is of commercial thickness at all points, because the records are too scattered to make the evidence conclusive, but since it is found in such borings as have been made, this district is outlined as probably containing the coal. Based on measurements at outcrop and thicknesses given in wells, an assumed thickness of 3 feet is warranted. With this assumption an estimate by Reger gives the following tabulated results:

#### Available Upper Kittanning Coal.

| Counties.        | Square Miles. | Acres.  | Cubic Feet of Coal. | Short Tons of Coal. |
|------------------|---------------|---------|---------------------|---------------------|
| Monongalia ..... | 35.28         | 22,579  | 2,950,623,720       | 118,024.950         |
| Marion .....     | 17.15         | 10,976  | 1,434,343,680       | 57,373.746          |
| Taylor .....     | 137.44        | 87,962  | 11,494,874,160      | 459,794,966         |
| Totals .....     | 189.87        | 121,517 | 15 879,841,560      | 635,193,662         |

#### *The Lower Kittanning Coal*

The Lower Kittanning coal, described in detail in Chapter VIII, is of wide distribution and excellent quality. As shown by the Table of Coal Analyses it is almost equal to the Upper Freeport in calorific value and the sulphur content so low that much of it can be used for coke. Its outcrop is shown on Map II and its areal distribution on Figure 11. There are only three commercial mines, all located in Taylor county. These have been visited and sampled by members of the Survey. Their description follows in the text and the analyses may be found in the table at the end of this chapter under their mine numbers.



**Winona Coal & Coke Co., Mine No. 2.—No. 95 on Map II.**

Located at Coffman (Grafton R. F. D.); Lower Kittanning coal.

|                               | Feet. | Inches |
|-------------------------------|-------|--------|
| 1. Sandstone, massive .....   |       |        |
| 2. Shale, hard, gray .....    | 2     | 0      |
| 3. Slate, black .....         | 0     | 3      |
| 4. Cannel slate .....         | 0     | 5      |
| 5. Coal, good, hard.....1' 2" |       |        |
| 6. Coal, bony.....0 9         |       |        |
| 7. Coal, good, soft.....2 10  | 4     | 9      |
| 8. Shale, gray.               |       |        |

"Tidal elevation, 1014'; hand level; principal office, Ruffs Dale, Pa.; daily capacity, 300 tons; 20 laborers and 20 miners employed; electric haulage; used for steam and coke; shipped east and west; butts, N 78° W; faces N 12° E; greatest rise, northwest; sample collected for analysis from Nos. 5 and 7 of section in Room No. 6, Third Left Heading, by D. B. Reger; F. C. Tarr, Supt., authority for data."

This company operates 30 bee-hive coke ovens, the product from which is mostly used for heating purposes. When a superior grade of coke is desired, the bottom coal, No. 7 of section, is used alone. A sample of 72-hour coke shows the following analysis according to Messrs. Hite and Krak:

|                      | Per cent. |
|----------------------|-----------|
| Moisture .....       | 0.04      |
| Volatile Matter..... | 0.83      |
| Fixed Carbon .....   | 82.97     |
| Ash .....            | 16.16     |
| Total.....           | 100.00    |
| Sulphur .....        | 2.54      |
| Phosphorus .....     | 0.53      |

**Sterling Coal Co.—No. 97 on Map II.**

Located at Cecll; Lower Kittanning coal.

|                                | Feet. | Inches |
|--------------------------------|-------|--------|
| 1. Slate, good roof.....       |       |        |
| 2. Coal, medium hard.....1' 6" |       |        |
| 3. Coal, bony, 6" to.....0 8   |       |        |
| 4. Coal, soft.....1 8          | 3     | 10     |
| 5. Slate.                      |       |        |

"Tidal elevation, 1100', aneroid; greatest rise, southeast; mine capacity, 300 tons; used for coke, steam and domestic purposes; authority for mine data, J. E. Hamilton, mine foreman; sample collected for analysis from Nos. 2 and 4 of section by Ray V. Hennen."

**Overholt Coal & Co.—No. 98 on Map II.**

Located 0.4 mile southwest of Cecil; **Lower Kittanning coal.**

|  | Feet. | Inches |
|--|-------|--------|
| 1. Sandstone, hard.....                    | 6     | 0      |
| 2. Sandstone, shaly.....                   | 4     | 0      |
| 3. Slate, dark.....                        | 5     | 0      |
| 4. Coal.....                               | 0     | 1 "    |
| 5. Slate, black, cannel.....               | 0     | 5      |
| 6. Coal, good, hard.....                   | 1     | 8      |
| 7. Coal, hard, with slate and<br>bone..... | 0     | 10     |
| 8. Coal.....                               | 0     | 6      |
| 9. Slate, black.....                       | 0     | 0½     |
| 10. Coal, soft, good.....                  | 2     | 0      |
|  | 5     | 6½     |

## 11. Shale, gray.

"Tidal elevation, 1051', spirit level; greatest rise, southeast; sample collected for analysis from Nos. 6, 8, 9 and 10 of section in Main Heading by D. B. Reger."

This mine is located on the south side of the Tygart Valley river along the Buckhannon and Northern railroad right-of-way. When construction work was abandoned on the railroad, work ceased also at the mine. The sample taken shows a large amount of moisture which is due to the fact that a fresh working face could not be found. The air dried sample indicates more clearly the true quality of the coal.

**Quantity of Lower Kittanning Coal Available.**

As shown on Figure 11, there is a large amount of Lower Kittanning coal lying under drainage in Marion and Taylor counties. Although the evidence is by no means absolute, the coal has been indicated on the figure for this locality because nearly all the well records note its presence. Many additional core tests would be necessary to determine fully its extent and character. The following table gives the evidence upon which this assumption was based:



## List of Wells Recording Lower Kittanning Coal.

| No. on Map                | NAME OF WELL                       | DIRECTION                        | Elevatio-           | Depth. | Thickness |
|---------------------------|------------------------------------|----------------------------------|---------------------|--------|-----------|
|                           |                                    |                                  | of Well Mouth A. T. |        |           |
| <b>Monongalia County:</b> |                                    |                                  |                     |        |           |
| 272                       | John Laird (E. Roach) No. 1.....   | Maidsville, 1.4 m. S 80° W.....  | 1135B               | 1021   | 6         |
| 322A                      | Wayne Wilson No. 1..               | VanVoorhis, 1 m. SE              | .....               | 494    | 3         |
| 344                       | Rose Watson No. 1907               | Smithtown, 0.4 m. S.             | 970B                | 227    | 5         |
| <b>Marion County:</b>     |                                    |                                  |                     |        |           |
| 666                       | A. Boutlou No. 1.....              | Montana, 1 m. W....              | 950B                | 1020   | 5         |
| 680                       | Harriet Frum No. 1..               | Boothsville, 0.6 m. N 20° W..... | 995B                | 640    | 8         |
| 687                       | W. R. Jasper Hrs. No. 1            | Celfax .....                     | 926L                | 252    | 10        |
| 688                       | J. F. Vangilder No. 1.             | Kingmont, 1.6 m. E.              | 975B                | 583    | 7         |
| <b>Taylor County:</b>     |                                    |                                  |                     |        |           |
| 700                       | Harrison Jones Hrs. No. 1.....     | Pruntytown, 1.1 m. NW .....      | 1205B               | 455    | 5         |
| 700A                      | Henry Swindler No. 1.              | Pruntytown, 1.1 m. NW .....      | .....               | 682    | 12        |
| 702                       | C. E. Dunham No. 1..               | Pruntytown, 1:5 m. W .....       | 1268L               | 605    | 2         |
| 702A                      | Brown Hrs. No. 1.....              | Pruntytown, 1.6 m. W .....       | .....               | 468    | 8         |
| 704A                      | T. A. Gawthrop No. 1.              | Pruntytown, 2 m. SW              | .....               | 470    | 4         |
| 705                       | Geo. W. Reynolds No. 1             | Meadland, 2 m. E...              | 1180B               | 528    | 10        |
| 708                       | Lizzie E. Morrow No. 2250 .....    | Meadland, 0.7 m. E.              | 1328L               | 480    | 3         |
| 709                       | Dan Copeland No. 1..               | Meadland, 1.1 m. SE              | 1372B               | 670    | 10        |
| 715A                      | Clare F. Shafer No. 1.             | Pruntytown, 2.4 m. SW .....      | 1240B               | 795    | 3         |
| 719                       | A. J. Bartlett core test           | Webster .....                    | 1006L               | 266    | 5.8       |
| 724                       | E. H. Bennett core test No. 2..... | Stonehouse, 0.2 m. N             | 1022L               | 133.5  | 6         |
| 726                       | Lucinda McDaniel No. 1 .....       | Stonehouse .....                 | 998L                | 90     | 4         |

From the table above and from measurements made at outcrop, it is safe to assume an average thickness of 4 feet for the Lower Kittanning coal in the territory outlined in Figure II. With this assumption the following tonnage estimate has been prepared by Reger:

**Available Lower Kittanning Coal.**

| Counties.        | Square Miles. | Acres.  | Cubic Feet of Coal. | Short Tons of Coal. |
|------------------|---------------|---------|---------------------|---------------------|
| Monongalia ..... | 24.01         | 15,366  | 2,677,371,840       | 107,094,874         |
| Marion .....     | 66.40         | 42,496  | 7,408,503,040       | 296,340,122         |
| Taylor .....     | 143.32        | 91,725  | 15,982,164,000      | 639,286,560         |
| Total.....       | 233.73        | 149 587 | 26,068,038,880      | 1,042,721,556       |

**MINABLE COALS OF THE POTTSVILLE SERIES.***The Upper Mercer Coal*

The Upper Mercer Coal, which has been described in Chapter IX, is the only coal of the Pottsville Series that is thick enough to be mined. As shown by the Table of Coal Analyses at the end of this chapter, this coal is high in ash, but low in sulphur and phosphorus. Since it nearly always contains a thick stratum of soft shale near the middle that easily crumbles, there is difficulty in mining the coal successfully.

**Quantity of Upper Mercer Coal Available.**

This coal is not recorded in wells west of the Monongahela river. East of the river it is of minable thickness just southeast of Sturgisson, Monongalia county. North of Halleck it was noted at several points. At Powell and Valley Falls on the Tygart Valley river it is well developed. In Booths Creek and Courthouse districts, Taylor county, several wells record its occurrence but the evidence is too uncertain to make an intelligent estimate of the amount. The following table shows such information as could be had concerning its occurrence under drainage:

## List of Wells Recording Upper Mercer Coal.

| No. on Map | NAME OF WELL                           | LOCATION                        | Elevation of Well Mouth A. T. | Depth. Feet | Thickness. Feet |
|------------|--|---------------------------------|-------------------------------|-------------|-----------------|
| 326        | Monongalia:<br>Francis Costolo No. 1.  | 1.2 m. SE of Cheat Haven .....  | 808L                          | 560         | 3               |
| 697        | Taylor County:<br>Martha Tucker No. 1. | Valley Falls, 1 m. S 10° W..... | 1080B                         | 235         | 7               |
| 700        | Harrison Jones Hrs. No. 1.....         | Pruntytown, 1.1 m. NW .....     | 1205B                         | 530         | 9               |
| 700A       | Henry Swindler No. 1.                  | Pruntytown, 1.1 m. NW .....     | .....                         | 825         | 9               |
| 702        | C. E. Dunham No. 1..                   | Pruntytown, 1.5 m. NW .....     | 1268L                         | 785         | 2               |
| 702A       | Brown Heirs No. 1.....                 | Pruntytown, 1.6 m. W .....      | .....                         | 585         | 3               |
| 703        | Hugh Evans No. 2....                   | Pruntytown, 2 m. S. 75° W.....  | 1101L                         | 475         | 6               |
| 704A       | T. A. Gawthrop No. 1.                  | Pruntytown, 2 m. SW .....       | .....                         | 580         | 6               |
| 705        | Geo. W. Reynolds No. 1 .....           | Meadland, 2 m. E...             | 1180B                         | 653         | 10              |
| 715        | Sarah E. Whitescarver No. 1.....       | Pruntytown. 2.4 m. SW .....     | 1115B                         | 690         | 8               |
| 715        | Clare F. Shafer No. 1.                 | Pruntytown. 2.4 m. SW .....     | 1240B                         | 885         | 4               |

## Summary of Available Coal.

|                            | Short Tons.   |
|----------------------------|---------------|
| Washington coal.....       | 585,188,597   |
| Waynesburg coal.....       | 1,301,640,473 |
| Sewickley coal.....        | 1,979,590,715 |
| Redstone coal.....         | 5,027,032     |
| Pittsburgh coal.....       | 3,376,000,000 |
| Upper Freeport coal.....   | 357,490,298   |
| Upper Kittanning coal..... | 635,193,662   |
| Lower Kittanning coal..... | 1,042,721,556 |
| Grand total.....           | 9,282,852,243 |

This summary represents the amount of coal remaining in the ground. Since the entire amount cannot be mined, a reduction must be made for pillars. Many of the companies operating the Pittsburgh coal recover 95 per cent, but the recovery of all the other seams will be less, some of them not

exceeding 50 per cent. Perhaps an estimated recovery of 80 per cent would be within safe limits. On this basis the total amount of coal available would be 7,426,281,794 short tons.

## MINABLE COAL BY MAGISTERIAL DISTRICTS.

### Monongalia County.

**Battelle District.**—The Washington, Waynesburg, Sewickley and Pittsburgh coals are present over the entire area of Battelle district. They are all deeply buried underground and available only for shaft mining. The elevation of the Pittsburgh coal above sea level is shown on Map II and the approximate elevation of the others may be computed at any location desired. In addition to the discussion in this chapter these coals have been described in Chapters V and VI. The only surface coals in the district are so thin that they cannot be mined successfully.

**Clay District.**—In Clay district are found the Washington, Waynesburg, Sewickley and Pittsburgh coals. Of these, the Washington crops in the eastern end of the district and the Waynesburg crops at one locality, near Hagans in the extreme southeastern corner. The crop of both these coals is shown on Map II. The coals are all described in Chapters V and VI and the tonnage estimates given in the present chapter.

**Cass District.**—In Cass district the minable coals are the Washington, Waynesburg, Sewickley, Redstone, Pittsburgh, and Upper Kittanning. Of these, all except the Upper Kittanning crop at some locality in the district. The crops of the Washington, Waynesburg and Pittsburgh are shown on Map II. The descriptions of these coals are given in Chapters V, VI and VIII, and the tonnage estimates in the present chapter.

**Grant District.**—The minable coals of Grant district are the Washington, Waynesburg, Sewickley, Redstone, Pittsburgh and Upper Freeport, all of which reach the surface. The crops of the Washington, Waynesburg, Pittsburgh and Upper Freeport are shown on Map II. These coals are described in Chapters V, VI and VIII and the tonnage estimates given in the present chapter. The quantity of Upper Freeport is very small.

**Union District.**—The minable coals of Union district are the Sewickley, Pittsburgh and Upper Freeport, all of which reach the surface. The crops of the Pittsburgh and Upper Freeport are shown on Map II. The descriptions of these coals are given in Chapters VI and VIII and the tonnage estimates in the present chapter. Map II also shows the western boundary where the Upper Freeport becomes too thin for mining.

**Morgan District.**—The minable coals of Morgan district are the Pittsburgh, Upper Freeport and Upper Mercer, all of which crop above drainage at some locality. The crops of the Pittsburgh and Upper Freeport are shown on Map II. The descriptions of these coals are given in Chapters VI, VIII and IX and the tonnage estimates in the present chapter.

**Clinton District.**—The minable coals of Clinton district are the Pittsburgh, Upper Freeport, Upper Kittanning, Lower Kittanning and Upper Mercer, all of which crop above drainage. Of these, the crops of the Pittsburgh, Upper Freeport and Lower Kittanning are shown on Map II. The descriptions of these coals are given in Chapters VI, VIII and IX and the tonnage estimates in the present chapter.

### Marion County.

**Mannington District.**—The minable coals of Mannington district are the Washington, Waynesburg, Sewickley and Pittsburgh. Of these, the Washington crops over a limited area in the eastern portion of the district and the Waynesburg in a few localities in the southeast corner. The crops of both are shown on Map II. Map II also shows the elevation of the Pittsburgh above sea level. The descriptions of these coals are given in Chapters V and VI and the tonnage estimates in the present chapter.

**Pawpaw District.**—The minable coals of Pawpaw district are the Washington, Waynesburg, Sewickley and Pittsburgh, all of which crop at some locality. The crops of the Washington, Waynesburg and Pittsburgh are shown on Map II. The descriptions of these coals are given in Chapters V and VI and the tonnage estimates in the present chapter.

**Lincoln District.**—The minable coals of Lincoln district are the Washington, Waynesburg, Sewickley and Pittsburgh all of which crop at some locality. The crops of the Washington, Waynesburg and Pittsburgh are shown on Map II. The descriptions of these coals are given in Chapters V and VI and the tonnage estimates in the present chapter.

**Fairmont District.**—In Fairmont district the minable coals are the Washington, Waynesburg, Sewickley and Pittsburgh, all of which crop at some locality. The crops of the Washington, Waynesburg, and Pittsburgh are shown on Map II. The descriptions of these coals are given in Chapters V and VI and the tonnage estimates in the present chapter.

**Grant District.**—The minable coals of Grant district are the Waynesburg, Pittsburgh, Lower Kittanning and Upper Mercer, all of which crop at some locality. The Waynesburg is only found in a few isolated hill-tops and is scarcely worthy of mention. The crops of the Waynesburg, Pittsburgh and Lower Kittanning are shown on Map II. The descriptions of these coals are given in Chapters VI, VIII and IX and the tonnage estimates in the present chapter.

**Winfield District.**—In Winfield district the minable coals are the Pittsburgh, Upper Freeport, Upper Kittanning and Lower Kittanning, all of which crop at some locality. The crops of all except the Upper Kittanning are shown on Map II. These coals are described in Chapters VI and VIII and the tonnage estimates given in the present chapter.

**Union District.**—The minable coals of Union district are the Pittsburgh, Upper Freeport, Upper Kittanning, Lower Kittanning and Upper Mercer, all of which crop in some locality. The crops of the Pittsburgh, Upper Freeport, and Lower Kittanning are shown on Map II. These coals are described in Chapters VI, VIII and IX and the tonnage estimates given in the present chapter.

### Taylor County.

**Booths Creek District.**—In Booths Creek district the minable coals are the Pittsburgh, Upper Kittanning, Lower Kittanning and Upper Mercer, all of which crop at some

locality. The Upper Freeport coal is not of minable thickness where its horizon crops and it is seldom noted in well records where it should lie under drainage. The crops of the Pittsburgh coal, the Upper Freeport horizon, and the Lower Kittanning coal are shown on Map II. These coals are described in Chapters VI, VIII and IX and the tonnage estimates given in the present chapter.

**Flemington District.**—The minable coals of Flemington district are the Pittsburgh, Upper Kittanning and Lower Kittanning. Of these, only the Pittsburgh crops above drainage. Its crop is shown on Map II. These coals are described in Chapters VI and VIII, and the tonnage estimates given in the present chapter. The evidence regarding the Upper Freeport is not conclusive, but most of the wells drilled do not record it.

**Courthouse District.**—In Courthouse district the minable coals are the Pittsburgh, Upper Kittanning, Lower Kittanning and possibly the Upper Mercer. The well records indicate that the Upper Freeport is too irregular to be of value. The Pittsburgh, which crops above drainage, is shown on Map II. These coals are described in Chapters VI, VIII and IX, and the tonnage estimates are given in the present chapter.

**Fetterman District.**—The minable coals of Fetterman district are probably the Upper Freeport, Upper Kittanning and Lower Kittanning. These coals all crop at some locality. The fact that they are of minable thickness where they crop in the district and in adjoining regions is the only evidence for believing that they are good where their horizons are under drainage. There are no wells or core tests. Since the Upper Mercer coal does not crop there is no information on which to base a statement regarding it. The crops of the Upper Freeport and Lower Kittanning are shown on Map II. These coals are described in Chapter VIII and their tonnage estimates given in the present chapter.

**Knottsville District.**—In Knottsville district the minable coals are the Upper Freeport, Upper Kittanning and Lower Kittanning. There are limited areas of Bakerstown coal that is of good quality and thickness. The Upper Freeport, in the western part of the district, is not of minable thickness either

at its crop or in the bore-holes that penetrate it. There is no evidence regarding the Upper Mercer except the McDaniel well (726) at Stonehouse where it was not found. The crops of the Upper Freeport and Lower Kittanning are shown on Map II. These coals are described in Chapters VII and VIII and tonnage estimates given in the present chapter.

#### TABLE OF COAL ANALYSES.

The following table, containing the chemical analysis, calorific determination and fuel ratio of 101 mines and prospects sampled in the territory of this report, is the exclusive work of members of the Survey staff. The chemical work is mostly by J. B. Krak, Assistant Chemist, under the supervision and with the assistance of B. H. Hite, Chief Chemist. The numbers at the left hand margin correspond to the numbers given with the mine sections in the text and on Map II. For additional explanation see page 644.



TABLE OF COAL ANALYSES.

(Under the heading, "Condition of Sample", "A. D."=air dried, and "A. R."=as received).

| Mine No. on Map | Mine.                  | County.     | Horizon.                 | Condition of Sample. |          |           |               | Proximate.  |         |           |         | Common to both. | Ultimate. |                                       |   |                                 |       |
|-----------------|------------------------|-------------|--------------------------|----------------------|----------|-----------|---------------|-------------|---------|-----------|---------|-----------------|-----------|---------------------------------------|---|---------------------------------|-------|
|                 |                        |             |                          | Ash.                 | Sulphur. | Moisture. | Fixed Carbon. | Phosphorus. | Carbon. | Hydrogen. | Oxygen. |                 | Nitrogen. | Calculated B. T. U for 1 lb. of coal. | Carbonimeter B. T. U for 1 lb. of coal. | Carbon divided by Oxygen + Ash. |       |
| 1               | Lewis Lemley           | Monongalia. | Nineveh, Min. sect.      |                      |          |           |               |             |         |           |         | A. R.           |           |                                       |   |                                 | 1.62  |
| 2               | Levi White             | Monongalia. | Dunkard, Min. sect.      | A. R.                | 1.91     | 35.88     | 47.51         | 0.215       | 14.70   | 1.83      | 66.65   | 4.60            | 11.08     | 11.14                                 | 12190                                   | 11770                           | 2.59  |
| 3               | Crop, public road      | Monongalia. | Jollytown, Min. sect.    | A. R.                | 1.93     | 33.63     | 47.79         | 0.053       | 16.65   | 2.73      | 65.20   | 4.73            | 9.91      | 11.14                                 | 12000                                   | 11740                           | 2.45  |
| 4               | Geo. C. Wright         | Monongalia. | Washington, U. bench     | A. R.                | 1.24     | 33.68     | 43.05         | 0.012       | 22.03   | 3.51      | 60.16   | 4.27            | 9.04      | 10.99                                 | 11420                                   | 10840                           | 1.94  |
| 4               | Geo. C. Wright         | Monongalia. | Washington, L. bench     | A. R.                | 1.55     | 33.74     | 47.06         | 0.023       | 7.66    | 2.02      | 74.50   | 5.17            | 9.35      | 11.30                                 | 13700                                   | 13400                           | 4.38  |
| 5               | Unknown                | Marion      | Washington, L. bench     | A. R.                | 1.43     | 35.99     | 50.86         | 0.005       | 11.72   | 2.98      | 69.55   | 5.12            | 9.58      | 11.05                                 | 12710                                   | 12670                           | 3.27  |
| 6               | Average                | Marion      | Washington, L. bench     | A. R.                | 1.49     | 34.86     | 53.96         | 0.014       | 9.69    | 2.50      | 72.02   | 5.15            | 9.46      | 11.18                                 | 13205                                   | 13035                           | 3.76  |
| 6               | Crop, public road      | Marion      | Waynesb'g 'A' Min. sect. | A. R.                | 1.81     | 34.59     | 45.99         | 0.035       | 18.51   | 4.32      | 60.89   | 4.43            | 10.83     | 11.02                                 | 11530                                   | 10940                           | 2.08  |
| 7               | Clark Wade             | Monongalia  | Waynesb'g Min. sect.     | A. R.                | 1.57     | 32.73     | 56.71         | 0.008       | 8.99    | 0.93      | 72.18   | 4.68            | 11.88     | 11.34                                 | 13460                                   | 12520                           | 3.46  |
| 7               | Clark Wade             | Monongalia  | Waynesb'g L. bench.      | A. R.                | 1.26     | 34.72     | 54.02         | 0.016       | 10.00   | 0.99      | 74.44   | 4.85            | 8.29      | 11.43                                 | 13420                                   | 13240                           | 4.07  |
| 7A              | Chas. Brand            | Monongalia  | Waynesb'g Min. sect.     | A. R.                | 0.40     | 36.50     | 52.91         | 0.015       | 10.19   | 2.25      | 71.38   | 4.77            | 10.05     | 11.36                                 | 13240                                   | 12650                           | 3.53  |
| 8               | Wm. Glasscock          | Monongalia  | Waynesb'g L. bench.      | A. R.                | 1.46     | 35.15     | 47.27         | 0.012       | 16.12   | 4.42      | 64.58   | 4.80            | 9.20      | 11.23                                 | 12340                                   | 11820                           | 2.65  |
| 9               | John Statler           | Marion      | Waynesb'g Min. sect.     | A. R.                | 1.82     | 34.73     | 51.71         | 0.009       | 11.74   | 1.98      | 69.97   | 5.23            | 9.69      | 11.39                                 | 12960                                   | 12750                           | 3.27  |
| 10              | C. J. Martin           | Marion      | Waynesb'g Min. sect.     | A. R.                | 1.63     | 33.14     | 48.05         | 0.015       | 17.18   | 1.76      | 66.51   | 4.49            | 8.74      | 11.32                                 | 12520                                   | 11850                           | 2.57  |
| 11              | M. V. Traction Co.     | Marion      | Waynesb'g Min. sect.     | A. R.                | 1.69     | 34.86     | 52.58         | 0.050       | 10.37   | 2.96      | 69.02   | 4.83            | 10.86     | 11.46                                 | 12950                                   | 12310                           | 3.18  |
| 11              | M. V. Traction Co.     | Marion      | Waynesb'g Min. sect.     | A. R.                | 1.89     | 34.15     | 49.70         | 0.023       | 14.26   | 3.51      | 67.42   | 4.51            | 9.05      | 11.25                                 | 12440                                   | 12040                           | 2.89  |
| 12              | W. I. Nuttel           | Marion      | Waynesb'g Min. sect.     | A. R.                | 1.50     | 34.36     | 51.95         | 0.020       | 12.20   | 2.23      | 69.41   | 4.75            | 10.05     | 11.35                                 | 12928                                   | 12353                           | 3.12  |
|                 | Average                | Monongalia. | Waynesb'g L. bench.      | A. R.                | 1.36     | 34.94     | 50.64         | 0.014       | 13.06   | 2.53      | 69.51   | 4.83            | 8.64      | 11.33                                 | 12880                                   | 12530                           | 3.31  |
| 13              | B. & O. R. R. cut      | Marion      | L. Union't'n, Min. sect. | A. R.                | 7.29     | 33.96     | 50.12         | 0.010       | 8.63    | 1.79      | 63.31   | 4.54            | 20.50     | 12.33                                 | 11180                                   | 10610                           | 0.217 |
| Well            | T. W. Kinnan           | Monongalia  | Sewickley, Min. sect.    | A. R.                | 0.78     | 39.66     | 49.41         | 0.012       | 10.15   | 2.75      | 70.00   | 4.89            | 11.06     | 11.15                                 | 13500                                   | 13070                           | 3.30  |
| No. 20          | S. Z. T. Martin        | Monongalia  | Sewickley, Min. sect.    | A. R.                | 1.54     | 35.33     | 55.95         | 0.066       | 7.18    | 1.54      | 74.84   | 4.97            | 10.18     | 11.29                                 | 13870                                   | 13240                           | 4.31  |
| 14              | Parker Run C. & C. Co. | Marion      | Sewickley, Min. sect.    | A. D.                | 0.34     | 38.69     | 52.30         | 0.006       | 8.67    | 3.97      | 73.88   | 5.09            | 7.12      | 11.27                                 | 13640                                   | 13510                           | 4.08  |
| 15              | Parker Run C. & C. Co. | Marion      | Sewickley, Min. sect.    | A. R.                | 0.60     | 38.59     | 52.16         | 0.006       | 8.65    | 3.96      | 73.69   | 5.11            | 7.33      | 11.26                                 | 13600                                   | 13480                           | 4.61  |
| 15A             | Dakota C. & C. Co.     | Marion      | Sewickley, Min. sect.    | A. D.                | 0.72     | 38.13     | 52.07         | 0.035       | 9.08    | 3.61      | 74.43   | 4.97            | 6.65      | 11.26                                 | 13602                                   | 13539                           | 4.73  |
| 15A             | Dakota C. & C. Co.     | Marion      | Sewickley, Min. sect.    | A. R.                | 1.16     | 37.96     | 51.84         | 0.035       | 9.04    | 3.59      | 74.11   | 4.98            | 7.03      | 11.25                                 | 13542                                   | 13479                           | 4.01  |
|                 | Average                | Marion      | Sewickley, Min. sect.    | A. D.                | 0.53     | 38.41     | 52.19         | 0.020       | 8.87    | 3.79      | 74.16   | 5.03            | 6.88      | 11.27                                 | 13621                                   | 13525                           | 4.21  |
|                 | Average                | Marion      | Sewickley, Min. sect.    | A. R.                | 1.02     | 37.89     | 52.34         | 0.030       | 8.76    | 2.96      | 73.16   | 4.99            | 8.30      | 11.24                                 | 13628                                   | 13571                           | 4.21  |

TABLE OF COAL ANALYSES.

(Under the heading, "Condition of Sample", "A. D."—air dried, and "A. R."—as received).

| Mine No. on Map | Mine.                     | County.    | Horizon.               | Condition of Sample. |       | Proximate. |                  |               |             | Common to both. |          | Ultimate. |           |         |           |                      |                    |                     |                    |                                 |
|-----------------|---------------------------|------------|------------------------|----------------------|-------|------------|------------------|---------------|-------------|-----------------|----------|-----------|-----------|---------|-----------|----------------------|--------------------|---------------------|--------------------|---------------------------------|
|                 |                           |            |                        | A. R.                | A. D. | Moisture.  | Volatile Matter. | Fixed Carbon. | Phosphorus. | Ash.            | Sulphur. | Carbon.   | Hydrogen. | Oxygen. | Nitrogen. | Calorimeter B. T. U. | for 1 lb. of coal. | Calculated B. T. U. | for 1 lb. of coal. | Carbon divided by Oxygen + Ash. |
| 15B             | A. H. Tait                | Monongalia | Redstone, Min. sect.   | A. R.                | A. D. | 1.44       | 32.08            | 55.61         | 0.014       | 10.87           | 1.77     | 70.61     | 4.58      | 10.96   | 1.21      | 112630               | 12330              | 3.23                |                    |                                 |
| Well            |                           |            |                        |                      |       |            |                  |               |             |                 |          |           |           |         |           |                      |                    |                     |                    |                                 |
| No. 20          | T. W. Kinnan              | Monongalia | Pittsburgh, Min. sect. | A. R.                | A. D. | 0.95       | 40.65            | 52.57         | 0.007       | 5.83            | 2.53     | 76.90     | 5.29      | 8.23    | 1.22      | 14200                | 13930              | 5.47                |                    |                                 |
| 16              | Wm. Robinson              | Monongalia | Pittsburgh, Min. sect. | A. R.                | A. D. | 1.21       | 32.71            | 61.23         | 0.014       | 4.85            | 3.51     | 79.24     | 4.91      | 6.04    | 1.45      | 14360                | 14240              | 7.28                |                    |                                 |
| 17              | Elkins C. & C. Co. No. 5. | Monongalia | Pittsburgh, Min. sect. | A. D.                | A. D. | 1.40       | 34.80            | 54.57         | 0.019       | 9.23            | 2.07     | 78.55     | 4.64      | 4.31    | 1.20      | 14382                | 14056              | 5.80                |                    |                                 |
| 17              | Elkins C. & C. Co. No. 5. | Monongalia | Pittsburgh, Min. sect. | A. R.                | A. D. | 2.09       | 34.56            | 54.18         | 0.019       | 9.17            | 2.06     | 78.00     | 4.72      | 4.86    | 1.19      | 14282                | 13975              | 5.56                |                    |                                 |
| 18              | Great Scott C. & C. Co.   | Monongalia | Pittsburgh, Min. sect. | A. D.                | A. D. | 0.48       | 37.03            | 53.07         | 0.006       | 8.82            | 3.66     | 75.28     | 5.13      | 5.80    | 1.31      | 13760                | 13830              | 5.16                |                    |                                 |
| 18              | Great Scott C. & C. Co.   | Monongalia | Pittsburgh, Min. sect. | A. R.                | A. R. | 0.75       | 36.93            | 53.52         | 0.006       | 8.80            | 3.65     | 75.07     | 5.15      | 6.02    | 1.31      | 13720                | 13790              | 5.07                |                    |                                 |
| 18              | Great Scott C. & C. Co.   | Monongalia | Pittsburgh, head coal. | A. D.                | A. D. | 0.42       | 38.28            | 51.30         | 0.055       | 10.00           | 5.36     | 71.96     | 5.23      | 6.14    | 1.31      | 13630                | 13450              | 4.45                |                    |                                 |
| 18              | Great Scott C. & C. Co.   | Monongalia | Pittsburgh, head coal. | A. R.                | A. R. | 0.56       | 38.23            | 51.22         | 0.055       | 9.99            | 5.35     | 71.86     | 5.24      | 6.25    | 1.31      | 13610                | 13430              | 4.42                |                    |                                 |
| 19              | Antler Coal Co.           | Monongalia | Pittsburgh, Min. sect. | A. D.                | A. D. | 0.79       | 35.95            | 56.89         | 0.005       | 6.87            | 2.28     | 76.10     | 4.89      | 8.86    | 1.30      | 14030                | 136510             | 4.93                |                    |                                 |
| 19              | Antler Coal Co.           | Monongalia | Pittsburgh, Min. sect. | A. R.                | A. R. | 1.25       | 35.78            | 56.43         | 0.005       | 6.54            | 2.27     | 75.74     | 4.92      | 9.24    | 1.29      | 13970                | 13450              | 4.80                |                    |                                 |
| 20              | Cons. No. 30 (Beechwood)  | Monongalia | Pittsburgh, Min. sect. | A. R.                | A. R. | 4.46       | 34.68            | 54.60         | 0.007       | 6.36            | 1.77     | 73.54     | 5.42      | 11.58   | 1.33      | 13640                | 13230              | 4.10                |                    |                                 |
| 20              | Cons. No. 30 (Beechwood)  | Monongalia | Pittsburgh, Min. sect. | A. D.                | A. D. | 0.67       | 38.32            | 55.36         | 0.005       | 5.65            | 1.95     | 77.28     | 5.19      | 8.56    | 1.37      | 14290                | 13870              | 5.44                |                    |                                 |
| 21              | Pittsburgh Steam Coal Co. | Monongalia | Pittsburgh, Min. sect. | A. R.                | A. R. | 0.91       | 38.23            | 55.22         | 0.005       | 5.84            | 1.94     | 77.10     | 5.21      | 8.74    | 1.37      | 14260                | 13840              | 5.36                |                    |                                 |
| 21              | Pittsburgh Steam Coal Co. | Monongalia | Pittsburgh, Min. sect. | A. D.                | A. D. | 0.87       | 37.67            | 54.31         | 0.012       | 7.15            | 2.36     | 75.72     | 5.34      | 8.08    | 1.35      | 14050                | 13790              | 4.97                |                    |                                 |
| 22              | Cons. No. 45 (Murray)     | Marion     | Pittsburgh, Min. sect. | A. R.                | A. R. | 0.87       | 37.67            | 54.31         | 0.012       | 7.15            | 2.36     | 75.72     | 5.34      | 8.08    | 1.35      | 14050                | 13790              | 4.97                |                    |                                 |
| 22              | Cons. No. 45 (Murray)     | Marion     | Pittsburgh, Min. sect. | A. D.                | A. D. | 0.97       | 35.12            | 57.99         | 0.025       | 5.92            | 1.17     | 76.82     | 5.21      | 9.47    | 1.40      | 14170                | 13729              | 4.99                |                    |                                 |
| 23              | Catawba Coal Co.          | Marion     | Pittsburgh, Min. sect. | A. R.                | A. R. | 1.50       | 34.93            | 57.68         | 0.025       | 5.89            | 1.17     | 76.40     | 5.24      | 9.91    | 1.39      | 14100                | 13659              | 4.84                |                    |                                 |
| 24              | Pittsburgh Steam Coal Co. | Marion     | Pittsburgh, Min. sect. | A. D.                | A. D. | 0.93       | 36.75            | 55.79         | 0.006       | 6.53            | 1.73     | 77.01     | 5.25      | 8.11    | 1.37      | 14159                | 13900              | 5.26                |                    |                                 |
| 24              | Pittsburgh Steam Coal Co. | Marion     | Pittsburgh, Min. sect. | A. R.                | A. R. | 1.21       | 36.65            | 55.63         | 0.006       | 6.51            | 1.73     | 76.80     | 5.27      | 8.32    | 1.37      | 14110                | 13860              | 5.18                |                    |                                 |
| 25              | Va. & Pgh. C. & C. Co.    | Marion     | Pittsburgh, Min. sect. | A. R.                | A. R. | 1.05       | 37.00            | 56.30         | 0.019       | 5.65            | 1.55     | 77.94     | 5.21      | 8.23    | 1.42      | 14310                | 13990              | 5.62                |                    |                                 |
| 25              | Va. & Pgh. C. & C. Co.    | Marion     | Pittsburgh, Min. sect. | A. D.                | A. D. | 1.91       | 36.68            | 55.81         | 0.019       | 5.60            | 1.54     | 77.26     | 5.27      | 8.92    | 1.41      | 14190                | 13870              | 5.32                |                    |                                 |
| 26              | Cons. No. 24 (Montana)    | Marion     | Pittsburgh, Min. sect. | A. D.                | A. D. | 1.00       | 37.16            | 55.44         | 0.005       | 6.40            | 1.47     | 76.93     | 5.01      | 8.83    | 1.36      | 14130                | 13670              | 5.05                |                    |                                 |
| 26              | Cons. No. 24 (Montana)    | Marion     | Pittsburgh, Min. sect. | A. R.                | A. R. | 1.37       | 37.02            | 55.23         | 0.005       | 6.38            | 1.46     | 76.64     | 5.03      | 9.14    | 1.35      | 14080                | 13620              | 4.94                |                    |                                 |

TABLE OF COAL ANALYSES.

(Under the heading, "Condition of Sample", "A. D."=air dried, and "A. R."=as received).

| Mine No. on Map | Mine.                                      | County. | Horizon.               | Condition of Sample. | Proximate. |                  |               |             | Common to both. |          |         | Ultimate. |         |           | Calorimeter B. T. U. for 1 lb. of coal. | Calculated B. T. U. for 1 lb. of coal. | Carbon divided by Oxygen + Ash. |
|-----------------|--|---------|------------------------|----------------------|------------|------------------|---------------|-------------|-----------------|----------|---------|-----------|---------|-----------|---|--|---------------------------------|
|                 |  |         |                        |                      | Moisture.  | Volatile Matter. | Fixed Carbon. | Phosphorus. | Ash.            | Sulphur. | Carbon. | Hydrogen. | Oxygen. | Nitrogen. |   |  |                                 |
| 27              | Federal C. & C. Co.                        | Marion. | Pittsburgh, Min. sect. | A. D.                | 0.80       | 35.61            | 56.99         | 0.086       | 6.60            | 1.79     | 77.42   | 5.02      | 7.64    | 1.53      | 14188                                   | 13867                                  | 5.44                            |
| 27              | Federal C. & C. Co.                        | Marion. | Pittsburgh, Min. sect. | A. R.                | 1.39       | 35.40            | 56.65         | 0.086       | 6.56            | 1.78     | 76.96   | 5.06      | 8.12    | 1.52      | 14083                                   | 13774                                  | 5.24                            |
| 27              | Federal C. & C. Co.                        | Marion. | Pittsburgh bottom      | A. D.                | 0.71       | 35.03            | 54.71         | 0.061       | 9.55            | 3.75     | 73.88   | 4.88      | 6.66    | 1.28      | 13505                                   | 13409                                  | 4.55                            |
| 27              | Federal C. & C. Co.                        | Marion. | Pittsburgh bottom      | A. R.                | 1.75       | 34.66            | 54.14         | 0.061       | 9.45            | 3.71     | 73.11   | 4.94      | 7.53    | 1.26      | 13363                                   | 13269                                  | 4.56                            |
| 28              | New Central Coal Co.                       | Marion. | Pittsburgh, Min. sect. | A. D.                | 0.86       | 35.49            | 56.28         | 0.049       | 7.37            | 2.05     | 77.07   | 4.96      | 7.02    | 1.53      | 14188                                   | 13823                                  | 5.36                            |
| 28              | New Central Coal Co.                       | Marion. | Pittsburgh, Min. sect. | A. R.                | 2.67       | 34.84            | 55.25         | 0.048       | 7.24            | 2.01     | 75.66   | 5.07      | 8.52    | 1.50      | 13860                                   | 13570                                  | 4.80                            |
| 29              | Dakota C. & C. Co.                         | Marion. | Pittsburgh, Min. sect. | A. D.                | 0.52       | 37.26            | 55.99         | 0.024       | 6.23            | 1.21     | 77.52   | 5.36      | 8.17    | 1.51      | 14470                                   | 14020                                  | 5.38                            |
| 29              | Dakota C. & C. Co.                         | Marion. | Pittsburgh, Min. sect. | A. R.                | 0.80       | 37.16            | 55.83         | 0.024       | 6.21            | 1.20     | 77.30   | 5.38      | 8.41    | 1.50      | 14430                                   | 13980                                  | 5.28                            |
| 30              | Jamison C. & C. Co. No. 9 (South A)        | Marion. | Pittsburgh, Min. sect. | A. D.                | 0.87       | 37.51            | 55.30         | 0.006       | 6.32            | 1.63     | 76.57   | 5.24      | 8.73    | 1.51      | 14040                                   | 13780                                  | 5.09                            |
| 30              | Jamison C. & C. Co. No. 9 (South A)        | Marion. | Pittsburgh, Min. sect. | A. R.                | 1.13       | 37.42            | 55.15         | 0.006       | 6.30            | 1.62     | 76.37   | 5.26      | 8.95    | 1.50      | 14000                                   | 13750                                  | 5.01                            |
| 30              | Jamison C. & C. Co. No. 9 (North A)        | Marion. | Pittsburgh, Min. sect. | A. D.                | 0.79       | 37.80            | 55.08         | 0.020       | 6.33            | 2.05     | 77.03   | 5.27      | 7.85    | 1.47      | 14080                                   | 13930                                  | 5.43                            |
| 30              | Jamison C. & C. Co. No. 9 (North A)        | Marion. | Pittsburgh, Min. sect. | A. R.                | 0.99       | 37.73            | 54.96         | 0.020       | 6.32            | 2.05     | 76.88   | 5.28      | 8.00    | 1.47      | 14050                                   | 13900                                  | 5.37                            |
| 31              | Jamison C. & C. Co. No. 8 (Left extension) | Marion. | Pittsburgh, Min. sect. | A. D.                | 0.72       | 36.29            | 56.77         | 0.012       | 6.22            | 0.87     | 77.44   | 5.53      | 8.60    | 1.34      | 14060                                   | 14070                                  | 5.23                            |
| 31              | Jamison C. & C. Co. No. 8 (Left extension) | Marion. | Pittsburgh, Min. sect. | A. R.                | 1.04       | 36.17            | 56.59         | 0.012       | 6.20            | 0.87     | 77.19   | 5.54      | 8.86    | 1.34      | 14020                                   | 14030                                  | 5.13                            |
| 31              | Jamison C. & C. Co. No. 8 (Main heading)   | Marion. | Pittsburgh, Min. sect. | A. D.                | 0.68       | 35.76            | 58.02         | 0.005       | 5.54            | 0.98     | 78.03   | 5.37      | 8.76    | 1.32      | 14090                                   | 14040                                  | 5.46                            |
| 31              | Jamison C. & C. Co. No. 8 (Main heading)   | Marion. | Pittsburgh, Min. sect. | A. R.                | 1.27       | 35.55            | 57.68         | 0.005       | 5.50            | 0.98     | 77.57   | 5.40      | 9.24    | 1.31      | 14010                                   | 13960                                  | 5.26                            |
| 32              | Jamison C. & C. Co. No. 7 (South A)        | Marion. | Pittsburgh, Min. sect. | A. D.                | 0.52       | 38.36            | 53.14         | 0.009       | 7.98            | 2.31     | 75.23   | 5.10      | 7.97    | 1.41      | 13930                                   | 13580                                  | 4.72                            |
| 32              | Jamison C. & C. Co. No. 7 (South A)        | Marion. | Pittsburgh, Min. sect. | A. R.                | 0.83       | 38.24            | 52.97         | 0.009       | 7.96            | 2.30     | 75.00   | 5.11      | 8.22    | 1.41      | 13890                                   | 13540                                  | 4.63                            |

TABLE OF COAL ANALYSES.

(Under the heading, "Condition of Sample", "A. D." air dried, and "A. R." as received).

| Mine No. on Map | Mine.                               | County. | Horizon.               | Condition of Sample. | Proximate. |                  |               |             | Common to both. |          |         | Ultimate. |         |           | Calorimeter B. T. U. for 1 lb. of coal. | Calculated B. T. U. for 1 lb. of coal. | Carbon divided by Oxygen + Ash. |
|-----------------|-------------------------------------|---------|------------------------|----------------------|------------|------------------|---------------|-------------|-----------------|----------|---------|-----------|---------|-----------|---|--|---------------------------------|
|                 |                                     |         |                        |                      | Moisture.  | Volatile Matter. | Fixed Carbon. | Phosphorus. | Ash.            | Sulphur. | Carbon. | Hydrogen. | Oxygen. | Nitrogen. |   |  |                                 |
| 32              | Jamison C. & C. Co. No. 7 (North A) | Marion  | Pittsburgh, Min. sect. | A. D.                | 0.45       | 37.82            | 55.35         | 0.014       | 6.38            | 1.80     | 78.66   | 5.02      | 6.60    | 1.54      | 14210                                   | 14120                                  | 6.06                            |
| 32              | Jamison C. & C. Co. No. 7 (North A) | Marion  | Pittsburgh, Min. sect. | A. R.                | 0.55       | 37.78            | 55.30         | 0.014       | 6.37            | 1.79     | 78.55   | 5.03      | 6.68    | 1.54      | 14200                                   | 14110                                  | 6.02                            |
| 33              | Cons. No. 38 (Shaft)                | Marion  | Pittsburgh, Min. sect. | A. D.                | 0.87       | 37.60            | 54.25         | 0.005       | 7.28            | 2.54     | 75.34   | 5.14      | 8.28    | 1.42      | 13960                                   | 13610                                  | 4.84                            |
| 33              | Cons. No. 38 (Shaft)                | Marion  | Pittsburgh, Min. sect. | A. R.                | 1.03       | 37.53            | 54.17         | 0.005       | 7.27            | 2.54     | 75.23   | 5.15      | 8.40    | 1.42      | 13940                                   | 13590                                  | 4.80                            |
| 34              | Pat Hoge                            | Marion  | Pittsburgh, Min. sect. | A. D.                | 0.97       | 34.91            | 57.88         | 0.032       | 6.24            | 2.34     | 76.72   | 5.22      | 8.20    | 1.28      | 14202                                   | 13858                                  | 5.31                            |
| 34              | Pat Hoge                            | Marion  | Pittsburgh, Min. sect. | A. R.                | 1.93       | 34.57            | 57.32         | 0.032       | 6.18            | 2.31     | 75.99   | 5.27      | 8.99    | 1.26      | 14064                                   | 13724                                  | 5.01                            |
| 35              | Cons. No. 56 (Gaston)               | Marion  | Pittsburgh, Min. sect. | A. D.                | 0.90       | 36.48            | 56.24         | 0.017       | 6.38            | 1.40     | 76.67   | 5.00      | 9.21    | 1.34      | 14110                                   | 13600                                  | 4.92                            |
| 35              | Cons. No. 56 (Gaston)               | Marion  | Pittsburgh, Min. sect. | A. R.                | 1.50       | 36.25            | 55.91         | 0.017       | 6.34            | 1.39     | 76.20   | 5.04      | 9.70    | 1.33      | 14030                                   | 13520                                  | 4.75                            |
| 36              | Cons. No. 26 (New Eng.)             | Marion  | Pittsburgh, Min. sect. | A. D.                | 0.54       | 36.98            | 55.03         | 0.007       | 7.45            | 2.54     | 77.71   | 5.32      | 5.65    | 1.33      | 14220                                   | 14270                                  | 5.93                            |
| 36              | Cons. No. 26 (New Eng.)             | Marion  | Pittsburgh, Min. sect. | A. R.                | 0.77       | 36.90            | 54.90         | 0.007       | 7.43            | 2.53     | 77.53   | 5.33      | 5.86    | 1.33      | 14190                                   | 14240                                  | 5.84                            |
| 37              | Robinson Bros.                      | Marion  | Pittsburgh, Min. sect. | A. D.                | 0.85       | 36.86            | 53.90         | 0.018       | 8.39            | 2.53     | 73.22   | 5.14      | 9.34    | 1.38      | 13780                                   | 13200                                  | 4.13                            |
| 37              | Robinson Bros.                      | Marion  | Pittsburgh, Min. sect. | A. R.                | 1.77       | 36.52            | 53.40         | 0.018       | 8.31            | 2.51     | 72.54   | 5.19      | 10.08   | 1.37      | 13650                                   | 13080                                  | 3.94                            |
| 38              | Va. & Pgh. C. & C. Co. (Kingmont)   | Marion  | Pittsburgh, Min. sect. | A. D.                | 0.89       | 36.03            | 58.76         | 0.009       | 4.32            | 1.11     | 78.64   | 5.18      | 9.37    | 1.38      | 14570                                   | 13970                                  | 5.74                            |
| 38              | Va. & Pgh. C. & C. Co. (Kingmont)   | Marion  | Pittsburgh, Min. sect. | A. R.                | 1.14       | 35.94            | 58.61         | 0.009       | 4.31            | 1.11     | 78.44   | 5.20      | 9.56    | 1.38      | 14530                                   | 13940                                  | 5.66                            |
| 39              | Phillips Coal Co.                   | Marion  | Pittsburgh, Min. sect. | A. D.                | 0.82       | 38.31            | 54.57         | 0.009       | 6.30            | 1.94     | 76.36   | 5.26      | 8.72    | 1.42      | 14090                                   | 13770                                  | 5.08                            |
| 39              | Phillips Coal Co.                   | Marion  | Pittsburgh, Min. sect. | A. R.                | 1.16       | 38.18            | 54.38         | 0.009       | 6.28            | 1.93     | 76.11   | 5.28      | 8.99    | 1.41      | 14040                                   | 13720                                  | 4.98                            |
| 40              | Cons. No. 43 (Monongah No. 6)       | Marion  | Pittsburgh, Min. sect. | A. D.                | 0.91       | 34.62            | 58.23         | 0.019       | 6.24            | 1.36     | 76.61   | 5.24      | 9.18    | 1.37      | 14200                                   | 13730                                  | 4.97                            |
| 40              | Cons. No. 43 (Monongah No. 6)       | Marion  | Pittsburgh, Min. sect. | A. R.                | 1.21       | 34.52            | 58.05         | 0.019       | 6.22            | 1.35     | 76.38   | 5.25      | 9.42    | 1.37      | 14150                                   | 13690                                  | 4.88                            |
| 41              | Cons. No. 22 (Monongah No. 7)       | Marion  | Pittsburgh, Min. sect. | A. D.                | 1.20       | 35.45            | 57.87         | 0.007       | 5.48            | 1.50     | 76.72   | 5.10      | 9.82    | 1.38      | 14150                                   | 13630                                  | 5.01                            |
| 41              | Cons. No. 22 (Monongah No. 7)       | Marion  | Pittsburgh, Min. sect. | A. R.                | 1.63       | 35.29            | 57.62         | 0.007       | 5.46            | 1.49     | 76.38   | 5.13      | 10.17   | 1.37      | 14090                                   | 13570                                  | 4.89                            |

TABLE OF COAL ANALYSES.

(Under the heading, "Condition of Sample", "A. D."=air dried, and "A. R."=as received).

| Mine No. on Map | Mine.                           | County.     | Horizon.                | Condition of Sample. | Proximate. |                  |               |             | Common to both. |          |         | Ultimate. |         |           | Calorimeter B. T. U. for 1 lb. of coal. | Calculated B. T. U. for 1 lb. of coal. | Carbon divided by Oxygen + Ash. |
|-----------------|---------------------------------|-------------|-------------------------|----------------------|------------|------------------|---------------|-------------|-----------------|----------|---------|-----------|---------|-----------|---|--|---------------------------------|
|                 |                                 |             |                         |                      | Moisture.  | Volatile Matter. | Fixed Carbon. | Phosphorus. | Ash.            | Sulphur. | Carbon. | Hydrogen. | Oxygen. | Nitrogen. |   |  |                                 |
| 42              | Cons. No. 22 (Monongah (No. 5)) | Marion..... | Pittsburgh, Min. sect.. | A. D.                | 0.77       | 36.64            | 56.57         | 0.001       | 6.02            | 1.57     | 76.80   | 5.05      | 9.40    | 1.36      | 14050                                   | 13610                                  | 4.97                            |
| 42              | Cons. No. 22 (Monongah (No. 5)) | Marion..... | Pittsburgh, Min. sect.. | A. R.                | 0.99       | 36.56            | 56.44         | 0.011       | 6.01            | 1.57     | 76.43   | 5.06      | 9.57    | 1.36      | 14020                                   | 13580                                  | 4.91                            |
| 43              | Cons. No. 53 (Shaver)           | Marion..... | Pittsburgh, Min. sect.. | A. D.                | 0.73       | 37.44            | 56.96         | 0.017       | 5.87            | 1.58     | 76.93   | 5.24      | 8.95    | 1.43      | 14280                                   | 13810                                  | 5.19                            |
| 43              | Cons. No. 53 (Shaver)           | Marion..... | Pittsburgh, Min. sect.. | A. R.                | 0.88       | 37.38            | 55.88         | 0.017       | 5.86            | 1.58     | 76.82   | 5.25      | 9.06    | 1.43      | 14260                                   | 13790                                  | 5.15                            |
| 44              | Cons. No. 63 (Monongah No. 8)   | Marion..... | Pittsburgh, Min. sect.. | A. D.                | 0.48       | 34.82            | 54.70         | 0.034       | 10.00           | 0.74     | 73.75   | 4.98      | 9.17    | 1.36      | 13270                                   | 13130                                  | 3.85                            |
| 44              | Cons. No. 63 (Monongah No. 8)   | Marion..... | Pittsburgh, Min. sect.. | A. R.                | 0.88       | 34.68            | 54.48         | 0.034       | 9.96            | 0.74     | 73.46   | 5.00      | 9.49    | 1.35      | 13220                                   | 13080                                  | 3.78                            |
| 45              | Cons. No. 34 (Monongah No. 3)   | Marion..... | Pittsburgh, Min. sect.. | A. D.                | 0.68       | 36.61            | 57.18         | 0.044       | 5.53            | 0.80     | 77.75   | 5.24      | 9.25    | 1.43      | 14150                                   | 13890                                  | 5.26                            |
| 45              | Cons. No. 34 (Monongah No. 3)   | Marion..... | Pittsburgh, Min. sect.. | A. R.                | 1.16       | 36.44            | 56.90         | 0.044       | 5.50            | 0.80     | 77.38   | 5.27      | 9.63    | 1.42      | 14080                                   | 13820                                  | 5.11                            |
| 46              | Cons. No. 68 (Pennois)          | Marion..... | Pittsburgh, Min. sect.. | A. D.                | 0.98       | 36.04            | 57.59         | 0.051       | 5.39            | 0.89     | 77.48   | 5.15      | 9.57    | 1.52      | 14190                                   | 13770                                  | 5.17                            |
| 46              | Cons. No. 68 (Pennois)          | Marion..... | Pittsburgh, Min. sect.. | A. R.                | 1.39       | 35.90            | 57.34         | 0.051       | 5.37            | 0.89     | 77.17   | 5.17      | 9.88    | 1.52      | 14140                                   | 13720                                  | 5.06                            |
| 47              | H. B. Clark Coal Co. (No. 6)    | Marion..... | Pittsburgh, Min. sect.. | A. D.                | 0.93       | 36.24            | 58.51         | 0.028       | 4.32            | 1.02     | 77.93   | 5.45      | 9.99    | 1.29      | 14180                                   | 13950                                  | 5.45                            |
| 47              | H. B. Clark Coal Co. (No. 6)    | Marion..... | Pittsburgh, Min. sect.. | A. R.                | 1.50       | 36.04            | 58.17         | 0.028       | 4.29            | 1.01     | 77.48   | 5.48      | 10.46   | 1.28      | 14100                                   | 13900                                  | 5.45                            |
| 48              | H. B. Clark Coal Co. (No. 3)    | Marion..... | Pittsburgh, Min. sect.. | A. D.                | 0.99       | 37.08            | 57.72         | 0.036       | 4.24            | 0.88     | 78.26   | 5.08      | 10.24   | 1.30      | 14280                                   | 13780                                  | 5.40                            |
| 48              | H. B. Clark Coal Co. (No. 3)    | Marion..... | Pittsburgh, Min. sect.. | A. R.                | 1.66       | 36.80            | 57.33         | 0.036       | 4.21            | 0.87     | 77.73   | 5.12      | 10.78   | 1.29      | 14180                                   | 13680                                  | 5.19                            |
| 49              | H. B. Clark Coal Co. (No. 2)    | Marion..... | Pittsburgh, Min. sect.. | A. D.                | 0.90       | 36.53            | 58.02         | 0.025       | 4.55            | 0.99     | 77.53   | 5.17      | 10.40   | 1.36      | 14230                                   | 13720                                  | 5.19                            |
| 49              | H. B. Clark Coal Co. (No. 2)    | Marion..... | Pittsburgh, Min. sect.. | A. R.                | 1.18       | 37.21            | 56.07         | 0.025       | 4.51            | 0.98     | 76.84   | 5.21      | 11.11   | 1.35      | 14110                                   | 13600                                  | 4.92                            |
| 50              | Kilarm C. & C. Co. (No. 2)      | Marion..... | Pittsburgh, Min. sect.. | A. D.                | 1.34       | 36.78            | 56.40         | 0.037       | 5.54            | 1.54     | 76.74   | 5.08      | 9.83    | 1.27      | 14170                                   | 13610                                  | 4.99                            |
| 50              | Kilarm C. & C. Co. (No. 2)      | Marion..... | Pittsburgh, Min. sect.. | A. R.                | 1.00       | 37.54            | 54.71         | 0.010       | 6.75            | 2.99     | 74.20   | 4.91      | 10.78   | 1.25      | 14010                                   | 13450                                  | 4.66                            |
| 51              | Kilarm C. & C. Co. (No. 1)      | Marion..... | Pittsburgh, Min. sect.. | A. D.                | 1.50       | 37.35            | 54.43         | 0.010       | 6.72            | 2.98     | 73.82   | 4.95      | 10.28   | 1.21      | 13810                                   | 13140                                  | 4.34                            |
| 51              | Kilarm C. & C. Co. (No. 1)      | Marion..... | Pittsburgh, Min. sect.. | A. R.                | 0.95       | 37.93            | 56.15         | 0.038       | 4.97            | 1.26     | 76.54   | 5.21      | 10.52   | 1.50      | 14240                                   | 13600                                  | 4.94                            |

TABLE OF COAL ANALYSES.

(Under the heading, "Condition of Sample", "A. D." air dried, and "A. R." as received).

| Mine No. on Map | Mine.  | County. | Horizon.               | Condition of Sample. | Proximate. |                 |               | Common to both. |          |         |           | Ultimate. |           |   |  |                                 |      |
|-----------------|--|---------|------------------------|----------------------|------------|-----------------|---------------|-----------------|----------|---------|-----------|-----------|-----------|---|--|---------------------------------|------|
|                 |  |         |                        |                      | Moisture.  | Volatle Matter. | Fixed Carbon. | Ash.            | Sulphur. | Carbon. | Hydrogen. | Oxygen.   | Nitrogen. | Calorimeter B. T. U. for 1 lb. of coal. | Calculated B. T. U. for 1 lb. of coal. | Carbon divided by Oxygen + Ash. |      |
| 52              | Cons. No. 59 (Anderson)                              | Marion  | Pittsburgh, Min. sect. | A. R.                | 1.20       | 37.83           | 56.01         | 0.038           | 4.96     | 1.26    | 76.36     | 5.23      | 10.70     | 1.50                                    | 14210                                  | 13570                           | 4.88 |
| 53              | Cons. No. 36 (Highland)                              | Marion  | Pittsburgh, Min. sect. | A. D.                | 1.17       | 38.20           | 55.18         | 0.018           | 5.45     | 2.25    | 76.67     | 5.11      | 9.14      | 1.38                                    | 13960                                  | 13700                           | 5.25 |
| 53              | Cons. No. 36 (Highland)                              | Marion  | Pittsburgh, Min. sect. | A. R.                | 1.56       | 38.05           | 54.96         | 0.018           | 5.43     | 2.24    | 76.37     | 5.13      | 9.45      | 1.38                                    | 13910                                  | 13650                           | 5.13 |
| 54              | Cons. No. 47 (Middleton)                             | Marion  | Pittsburgh, Min. sect. | A. D.                | 0.84       | 37.92           | 52.97         | 0.012           | 8.27     | 2.90    | 73.62     | 5.14      | 8.72      | 1.35                                    | 13780                                  | 13420                           | 4.33 |
| 54              | Cons. No. 47 (Middleton)                             | Marion  | Pittsburgh, Min. sect. | A. R.                | 1.23       | 37.77           | 52.77         | 0.012           | 8.23     | 2.88    | 73.34     | 5.16      | 9.05      | 1.34                                    | 13730                                  | 13370                           | 4.25 |
| 55              | Cons. No. 28 (Chiefton)                              | Marion  | Pittsburgh, Min. sect. | A. D.                | 0.77       | 36.54           | 57.02         | 0.038           | 5.57     | 0.93    | 77.32     | 5.28      | 9.42      | 1.48                                    | 14150                                  | 13830                           | 5.16 |
| 55              | Cons. No. 28 (Chiefton)                              | Marion  | Pittsburgh, Min. sect. | A. R.                | 1.19       | 36.49           | 56.78         | 0.038           | 5.54     | 0.93    | 77.00     | 5.30      | 9.76      | 1.47                                    | 14090                                  | 13770                           | 5.03 |
| 56              | Cons. No. 84 (Paradise)                              | Marion  | Pittsburgh, Min. sect. | A. D.                | 0.87       | 37.35           | 55.21         | 0.024           | 6.57     | 1.42    | 76.30     | 5.26      | 9.06      | 1.39                                    | 14200                                  | 13720                           | 4.88 |
| 56              | Cons. No. 84 (Paradise)                              | Marion  | Pittsburgh, Min. sect. | A. R.                | 1.35       | 36.19           | 53.49         | 0.024           | 6.37     | 1.38    | 73.92     | 5.44      | 11.54     | 1.35                                    | 13760                                  | 13390                           | 4.07 |
| 57              | Cons. No. 67 (Hutchinson)                            | Marion  | Pittsburgh, Min. sect. | A. D.                | 0.99       | 36.55           | 56.23         | 0.027           | 6.23     | 1.40    | 77.47     | 5.29      | 8.22      | 1.39                                    | 14030                                  | 13970                           | 5.36 |
| 57              | Cons. No. 67 (Hutchinson)                            | Marion  | Pittsburgh, Min. sect. | A. R.                | 1.50       | 36.36           | 55.94         | 0.027           | 6.20     | 1.39    | 77.08     | 5.32      | 8.63      | 1.39                                    | 13960                                  | 13900                           | 5.20 |
| 58              | Four States C. & C. Co. (Annabelle) No. 2 Butt, East | Marion  | Pittsburgh, Min. sect. | A. D.                | 0.96       | 37.22           | 55.99         | 0.024           | 5.83     | 1.61    | 76.11     | 5.04      | 10.02     | 1.39                                    | 14040                                  | 13490                           | 4.78 |
| 58              | Four States C. & C. Co. (Annabelle) No. 2 Butt, East | Marion  | Pittsburgh, Min. sect. | A. R.                | 1.47       | 37.03           | 55.70         | 0.024           | 5.80     | 1.60    | 75.72     | 5.07      | 10.43     | 1.38                                    | 13970                                  | 13420                           | 4.67 |
| 58              | Four States C. & C. Co. (Annabelle) No. 1 Butt, East | Marion  | Pittsburgh, Min. sect. | A. D.                | 0.74       | 37.17           | 55.71         | 0.014           | 6.38     | 1.33    | 76.26     | 5.03      | 9.64      | 1.36                                    | 14010                                  | 13520                           | 4.76 |
| 58              | Four States C. & C. Co. (Annabelle) No. 1 Butt, East | Marion  | Pittsburgh, Min. sect. | A. R.                | 1.29       | 36.36           | 55.41         | 0.014           | 6.34     | 1.32    | 75.84     | 5.06      | 10.09     | 1.35                                    | 13940                                  | 13440                           | 4.62 |
| 58              | Four States C. & C. Co. (Annabelle) Left Main Dip    | Marion  | Pittsburgh, Min. sect. | A. D.                | 0.62       | 37.97           | 53.42         | 0.041           | 7.99     | 1.62    | 74.83     | 4.82      | 9.39      | 1.35                                    | 13720                                  | 13210                           | 4.31 |
| 58              | Four States C. & C. Co. (Annabelle) Left Main Dip    | Marion  | Pittsburgh, Min. sect. | A. R.                | 1.03       | 37.82           | 53.19         | 0.041           | 7.96     | 1.61    | 74.53     | 4.84      | 9.72      | 1.34                                    | 13670                                  | 13160                           | 4.22 |

TABLE OF COAL ANALYSES.

(Under the heading, "Condition of Sample", "A. D."=air dried, and "A. R."=as received).

| Mine No. on Map | Mine.                          | County. | Horizon.               | Condition of Sample | Proximate. |               |             |       | Common to both. |         |           |         | Ultimate. |                      |                    |                     |                    |
|-----------------|--------------------------------|---------|------------------------|---------------------|------------|---------------|-------------|-------|-----------------|---------|-----------|---------|-----------|----------------------|--------------------|---------------------|--------------------|
|                 |                                |         |                        |                     | Molature.  | Fixed Carbon. | Phosphorus. | Ash.  | Sulphur.        | Carbon. | Hydrogen. | Oxygen. | Nitrogen. | Calorimeter B. T. U. | for 1 lb. of coal. | Calculated B. T. U. | for 1 lb. of coal. |
| 59              | Harrison Coal Co.              | Taylor. | Pittsburgh, Min. sect. | A. D.               | 1.03       | 38.01         | 54.71       | 0.020 | 6.25            | 2.79    | 76.01     | 5.48    | 8.16      | 1.31                 | 14270              | 13930               | 5.27               |
| 59              | Harrison Coal Co.              | Taylor. | Pittsburgh, Min. sect. | A. R.               | 1.31       | 37.90         | 54.56       | 0.020 | 6.23            | 2.78    | 75.79     | 5.49    | 8.41      | 1.30                 | 14230              | 13890               | 5.18               |
| 60              | Rosemont Coal Co.              | Taylor. | Pittsburgh, Min. sect. | A. D.               | 0.93       | 39.13         | 53.86       | 0.012 | 6.08            | 3.17    | 76.84     | 5.54    | 7.27      | 1.30                 | 14280              | 14150               | 5.74               |
| 60              | Rosemont Coal Co.              | Taylor. | Pittsburgh, Min. sect. | A. R.               | 1.34       | 38.97         | 53.64       | 0.012 | 6.05            | 3.15    | 76.33     | 5.56    | 7.62      | 1.29                 | 14220              | 14090               | 5.58               |
| 61              | Pittsvein Coal Co.             | Taylor. | Pittsburgh, Min. sect. | A. D.               | 0.79       | 37.69         | 55.38       | 0.037 | 6.14            | 3.17    | 76.86     | 5.35    | 7.19      | 1.27                 | 14340              | 14070               | 5.77               |
| 61              | Pittsvein Coal Co.             | Taylor. | Pittsburgh, Min. sect. | A. R.               | 1.18       | 37.54         | 55.16       | 0.037 | 6.12            | 3.17    | 76.56     | 5.37    | 7.52      | 1.26                 | 14280              | 14020               | 5.62               |
| 62              | T. B. Davis Mine               | Taylor. | Pittsburgh, Min. sect. | A. D.               | 0.87       | 36.99         | 55.66       | 0.038 | 6.48            | 3.54    | 75.14     | 5.22    | 8.21      | 1.41                 | 14170              | 13680               | 5.12               |
| 62              | T. B. Davis Mine               | Taylor. | Pittsburgh, Min. sect. | A. R.               | 1.08       | 36.92         | 55.54       | 0.038 | 6.46            | 3.53    | 74.98     | 5.23    | 8.39      | 1.41                 | 14140              | 13650               | 5.05               |
| 63              | McGraw Coal Co. (N. Y.)        | Taylor. | Pittsburgh, Min. sect. | A. D.               | 0.33       | 38.88         | 53.67       | 0.035 | 7.12            | 3.45    | 75.22     | 5.26    | 7.68      | 1.27                 | 14400              | 13820               | 5.08               |
| 63              | McGraw Coal Co. (N. Y.)        | Taylor. | Pittsburgh, Min. sect. | A. R.               | 0.33       | 38.88         | 53.67       | 0.035 | 7.12            | 3.45    | 75.22     | 5.26    | 7.68      | 1.27                 | 14400              | 13820               | 5.08               |
| 64              | Grafton C. & C. Co.            | Taylor. | Pittsburgh, Min. sect. | A. D.               | 0.48       | 36.75         | 56.91       | 0.026 | 5.86            | 1.88    | 77.92     | 5.35    | 7.55      | 1.44                 | 14400              | 14140               | 5.81               |
| 64              | Grafton C. & C. Co.            | Taylor. | Pittsburgh, Min. sect. | A. R.               | 0.75       | 36.65         | 56.76       | 0.026 | 5.84            | 1.87    | 77.71     | 5.36    | 7.79      | 1.43                 | 14400              | 14100               | 5.70               |
| 65              | Maryland C. Co. (Wendel No. 4) | Taylor. | Pittsburgh, Min. sect. | A. D.               | 0.90       | 35.77         | 55.81       | 0.035 | 7.52            | 3.45    | 75.94     | 5.34    | 6.41      | 1.34                 | 13920              | 14000               | 5.45               |
| 65              | Maryland C. Co. (Wendel No. 4) | Taylor. | Pittsburgh, Min. sect. | A. R.               | 0.94       | 35.76         | 55.79       | 0.035 | 7.51            | 3.45    | 75.93     | 5.34    | 6.45      | 1.34                 | 13910              | 13990               | 5.44               |
| 66              | Maryland C. Co. (Wendel No. 1) | Taylor. | Pittsburgh, Min. sect. | A. D.               | 0.55       | 35.52         | 57.25       | 0.059 | 6.68            | 1.15    | 74.74     | 5.86    | 10.19     | 1.38                 | 14150              | 13780               | 4.43               |
| 66              | Maryland C. Co. (Wendel No. 1) | Taylor. | Pittsburgh, Min. sect. | A. R.               | 0.98       | 35.37         | 57.00       | 0.059 | 6.65            | 1.14    | 74.42     | 5.84    | 10.58     | 1.37                 | 14090              | 13700               | 4.32               |
| 67              | Maryland C. Co. (Wendel No. 5) | Taylor. | Pittsburgh, Min. sect. | A. D.               | 0.47       | 36.75         | 55.32       | 0.023 | 7.46            | 1.95    | 75.48     | 4.82    | 8.94      | 1.35                 | 14040              | 13360               | 4.60               |
| 67              | Maryland C. Co. (Wendel No. 5) | Taylor. | Pittsburgh, Min. sect. | A. R.               | 0.74       | 36.65         | 55.17       | 0.023 | 7.44            | 1.94    | 75.28     | 4.84    | 9.16      | 1.34                 | 14000              | 13320               | 4.53               |
| 68              | John Robinson (Kunst)          | Taylor. | Pittsburgh, Min. sect. | A. D.               | 0.66       | 35.56         | 54.74       | 0.095 | 9.04            | 3.02    | 74.26     | 5.07    | 7.22      | 1.39                 | 13830              | 13520               | 4.57               |
| 68              | John Robinson (Kunst)          | Taylor. | Pittsburgh, Min. sect. | A. R.               | 0.83       | 35.50         | 54.65       | 0.095 | 9.02            | 3.01    | 74.14     | 5.08    | 7.36      | 1.39                 | 13810              | 13500               | 4.53               |
|                 | Average                        |         | Pittsburgh, Min. sect. | A. D.               | 0.82       | 36.82         | 55.87       | 0.024 | 6.49            | 1.88    | 76.52     | 5.18    | 8.55      | 1.38                 | 14114              | 13760               | 5.09               |
|                 | Average                        |         | Pittsburgh, Min. sect. | A. R.               | 1.13       | 36.63         | 55.62       | 0.023 | 6.41            | 1.91    | 76.17     | 5.21    | 8.93      | 1.37                 | 14048              | 13705               | 4.97               |

TABLE OF COAL ANALYSES.

(Under the heading, "Condition of Sample", "A. D."—air dried, and "A. R."—as received).

| Mine No. on Map | Mine.                              | County.    | Horizon.                | Condition of Sample. | Proximate. |                  |               |             | Common to both. |          |         | Ultimate. |         |           | Calorimeter B. T. U for 1 lb. of coal. | Calculated B. T. U for 1 lb. of coal. | Carbon divided by Oxygen + Ash. |
|-----------------|------------------------------------|------------|-------------------------|----------------------|------------|------------------|---------------|-------------|-----------------|----------|---------|-----------|---------|-----------|--|---------------------------------------|---------------------------------|
|                 |                                    |            |                         |                      | Moisture.  | Volatile Matter. | Fixed Carbon. | Phosphorus. | Ash.            | Sulphur. | Carbon. | Hydrogen. | Oxygen. | Nitrogen. |  |                                       |                                 |
| 69              | Crop, Public road                  | Taylor     | Lit. Clksburg           | Min. sect. A. R.     | 6.59       | 29.43            | 45.23         | 0.106       | 18.75           | 1.05     | 57.72   | 4.20      | 17.58   | 0.70      | 9547                                   | 9684                                  | 1.59                            |
| 69A             | Regal Coal Co.                     | Monongalia | Elk Lick, Min. sect.    | A. R.                | 0.43       | 34.92            | 48.60         | 0.032       | 16.05           | 3.30     | 68.10   | 4.52      | 6.88    | 1.15      | 12660                                  | 12310                                 | 2.97                            |
| 70              | John Williams                      | Taylor     | Bakerstown, Min. sect.  | A. R.                | 0.84       | 31.84            | 59.96         | 0.044       | 7.36            | 1.82     | 76.50   | 5.26      | 7.74    | 1.32      | 14130                                  | 13860                                 | 5.26                            |
| 71              | J. J. Shryer                       | Taylor     | Bakerstown, Min. sect.  | A. R.                | 1.06       | 32.07            | 57.39         | 0.010       | 9.48            | 3.33     | 76.05   | 5.28      | 4.56    | 1.30      | 13740                                  | 14120                                 | 5.42                            |
|                 | Average                            |            | Bakerstown, Min. sect.  | A. R.                | 0.95       | 31.96            | 58.67         | 0.027       | 8.42            | 2.57     | 76.28   | 5.27      | 6.15    | 1.31      | 13935                                  | 13990                                 | 5.24                            |
| 72              | Crop, Public road                  | Marion     | Brush Creek             | Min. sect. A. R.     | 1.08       | 37.00            | 53.46         | 0.013       | 8.46            | 2.41     | 74.33   | 5.17      | 8.51    | 1.12      | 13820                                  | 13460                                 | 4.38                            |
| 73              | Chess Estate                       | Monongalia | U. Freeport, Min. sect. | A. R.                | 1.57       | 29.98            | 62.74         | 0.024       | 5.71            | 0.61     | 78.46   | 4.86      | 9.13    | 1.23      | 14380                                  | 13740                                 | 5.29                            |
| 74              | Elkins C. & C. Co. No. 1 (Richard) | Monongalia | U. " Cannel slate.      | A. D.                | 0.33       | 16.13            | 37.84         | 0.015       | 45.70           | 0.41     |         |           |         |           |  |                                       |                                 |
| 74              | Elkins C. & C. Co. No. 1 (Richard) | Monongalia | U. Freeport, Min. sect. | A. D.                | 1.30       | 34.80            | 56.42         | 0.025       | 7.48            | 0.99     | 77.73   | 5.00      | 7.69    | 1.11      | 13883                                  | 13851                                 | 5.12                            |
| 75              | Cannellville Basin Coke Co.        | Monongalia | U. Freeport, Min. sect. | A. D.                | 1.70       | 28.33            | 63.90         | 0.005       | 6.07            | 1.22     | 80.02   | 4.90      | 6.80    | 0.99      | 14135                                  | 14200                                 | 6.22                            |
| 76              | Terence Stewart                    | Monongalia | U. Freeport, Min. sect. | A. R.                | 1.23       | 31.24            | 61.93         | 0.025       | 5.71            | 0.72     | 78.96   | 4.84      | 8.61    | 1.16      | 14350                                  | 13880                                 | 5.51                            |
| 77              | Baldwin Weaver                     | Monongalia | U. Freeport, Min. sect. | A. R.                | 3.43       | 29.24            | 60.48         | 0.023       | 6.85            | 0.66     | 73.43   | 5.20      | 12.45   | 1.41      | 13260                                  | 12960                                 | 3.80                            |
| 78              | O. C. Johnson                      | Monongalia | U. Freeport, Min. sect. | A. R.                | 1.46       | 29.22            | 67.04         | 0.036       | 12.28           | 1.38     | 73.90   | 3.94      | 7.34    | 1.16      | 13230                                  | 12680                                 | 3.77                            |
| 79              | Daniel Morris                      | Monongalia | U. Freeport, Min. sect. | A. R.                | 2.19       | 28.94            | 64.32         | 0.117       | 14.56           | 0.75     | 68.01   | 4.50      | 11.11   | 1.08      | 12400                                  | 11850                                 | 2.65                            |
| 80              | U. G. Jennings                     | Taylor     | U. Freeport, Min. sect. | A. R.                | 1.14       | 32.19            | 57.52         | 0.023       | 9.15            | 1.50     | 75.63   | 5.18      | 7.35    | 1.19      | 13900                                  | 13700                                 | 4.58                            |
| 81              | Edith J. Harvey                    | Taylor     | U. Freeport, Min. sect. | A. R.                | 1.02       | 28.49            | 63.63         | 0.046       | 11.86           | 1.34     | 76.59   | 4.32      | 4.73    | 1.17      | 13440                                  | 13510                                 | 4.62                            |
|                 | Average                            |            | U. Freeport, Min. sect. | A. D.                | 1.50       | 31.57            | 60.16         | 0.015       | 6.77            | 1.11     | 78.88   | 4.95      | 7.24    | 1.05      | 14009                                  | 14025                                 | 5.63                            |
|                 | Average                            |            | U. Freeport, Min. sect. | A. R.                | 1.70       | 29.90            | 58.95         | 0.042       | 9.45            | 0.99     | 75.00   | 4.69      | 8.67    | 1.20      | 13566                                  | 13189                                 | 4.14                            |
| 82              | Emory Jones                        | Monongalia | U. Kittanning           | Min. sect. A. R.     | 1.10       | 30.11            | 69.47         | 0.052       | 9.32            | 1.42     | 75.11   | 4.85      | 7.84    | 1.46      | 13840                                  | 13380                                 | 4.38                            |
| 83              | W. A. C. Corrothers                | Taylor     | U. Kittanning           | Min. sect. A. R.     | 1.23       | 30.58            | 66.30         | 0.041       | 11.89           | 1.43     | 72.81   | 4.69      | 5.06    | 1.12      | 13190                                  | 13290                                 | 4.30                            |
| 84              | Winona C. & C. Co. No. 1.          | Taylor     | U. Kittanning           | Min. sect. A. D.     | 0.62       | 31.08            | 64.65         | 0.008       | 13.65           | 3.29     | 70.41   | 4.74      | 6.74    | 1.17      | 13040                                  | 12790                                 | 3.45                            |
| 84              | Winona C. & C. Co. No. 1.          | Taylor     | U. Kittanning           | Min. sect. A. R.     | 1.06       | 30.94            | 64.41         | 0.008       | 13.59           | 3.28     | 70.40   | 4.76      | 7.11    | 1.16      | 12980                                  | 12730                                 | 3.39                            |
| 85              | C. N. Mason                        | Taylor     | U. Kittanning           | Min. sect. A. R.     | 1.38       | 30.24            | 64.97         | 0.008       | 13.41           | 3.30     | 71.11   | 4.75      | 6.14    | 1.29      | 13040                                  | 12960                                 | 3.69                            |
|                 | Average                            |            | U. Kittanning           | Min. sect. A. R.     | 1.19       | 30.47            | 66.29         | 0.027       | 12.05           | 3.11     | 72.28   | 4.76      | 6.54    | 1.26      | 13083                                  | 13088                                 | 3.89                            |



TABLE OF COAL ANALYSES.

(Under the heading, "Condition of Sample", "A. D."=air dried, and "A. R."=as received).

| Mine No. on Map | Mine.                     | County.     | Horizon.                | Condition of Sample. | Proximate. |                  |               |             |       |          | Ultimate. |           |         | Calculated B. T. U. for 1 lb. of coal. | Calorimeter B. T. U. for 1 lb. of coal. | Carbon divided by Oxygen + Ash. |           |
|-----------------|---------------------------|-------------|-------------------------|----------------------|------------|------------------|---------------|-------------|-------|----------|-----------|-----------|---------|--|---|---------------------------------|-----------|
|                 |                           |             |                         |                      | Moisture.  | Volatile Matter. | Fixed Carbon. | Phosphorus. | Ash.  | Sulphur. | Carbon.   | Hydrogen. | Oxygen. |  |   |                                 | Nitrogen. |
| 86              | J. H. McClaren            | Monongalia. | L. Kitt'ing, Min. sect. | A. R.                | 1.50       | 32.54            | 59.22         | 0.005.      | 6.71  | 2.07     | 77.59     | 4.80      | 7.49    | 1.34                                   | 14320                                   | 13780                           | 9.46      |
| 87              | Joseph Reppert            | Monongalia. | L. Kitt'ing, Min. sect. | A. R.                | 1.43       | 29.85            | 58.61         | 0.006       | 10.11 | 2.35     | 74.60     | 5.10      | 6.56    | 1.28                                   | 13680                                   | 13600                           | 4.48      |
| 88              | Unknown                   | Monongalia. | L. Kitt'ing, Min. sect. | A. R.                | 1.32       | 30.28            | 55.02         | 0.011       | 12.38 | 7.63     | 67.91     | 5.01      | 5.42    | 1.15                                   | 12860                                   | 12860                           | 3.71      |
| 89              | Samuel Frederick          | Monongalia. | L. Kitt'ing, Min. sect. | A. R.                | 1.80       | 29.19            | 57.29         | 0.085       | 11.72 | 1.08     | 74.51     | 4.43      | 7.03    | 1.23                                   | 13030                                   | 13080                           | 3.97      |
| 90              | Marcellus Jolliffe        | Marion      | L. Kitt'ing, Min. sect. | A. R.                | 1.18       | 28.89            | 54.47         | 0.010       | 15.46 | 2.68     | 70.17     | 4.80      | 5.77    | 1.12                                   | 12670                                   | 12850                           | 3.31      |
| 91              | Owen Vincent              | Marion      | L. Kitt'ing, Min. sect. | A. R.                | 1.51       | 38.92            | 45.20         | 0.034       | 14.37 | 1.15     | 70.77     | 5.14      | 7.42    | 1.15                                   | 12970                                   | 12950                           | 3.25      |
| 92              | Jacob Rogers              | Marion      | L. Kitt'ing, Min. sect. | A. R.                | 0.46       | 26.98            | 47.21         | 0.030       | 25.35 | 0.77     | 63.01     | 4.31      | 5.57    | 0.99                                   | 11690                                   | 11440                           | 2.94      |
| 93              | Jacob Rogers              | Marion      | L. Kitt'ing, U. bench.  | A. R.                | 0.79       | 27.49            | 52.22         | 0.015       | 19.50 | 1.68     | 66.58     | 4.32      | 6.84    | 1.08                                   | 12300                                   | 11900                           | 2.53      |
| 93              | Jacob Rogers              | Marion      | L. Kitt'ing, U. bench.  | A. R.                | 0.60       | 25.69            | 41.66         | 0.064       | 32.05 | 1.90     | 56.71     | 4.06      | 4.30    | 0.98                                   | 10330                                   | 10510                           | 1.56      |
| 94              | Chas. Sapp                | Taylor      | L. Kitt'ing, Min. sect. | A. R.                | 0.70       | 29.75            | 62.17         | 0.012       | 7.38  | 1.85     | 77.26     | 4.32      | 7.45    | 1.14                                   | 14300                                   | 13790                           | 5.21      |
| 95              | Winona C. & C. Co. No. 2. | Taylor      | L. Kitt'ing, Min. sect. | A. D.                | 0.79       | 30.83            | 57.66         | 0.019       | 10.72 | 5.28     | 74.19     | 4.84      | 6.44    | 1.23                                   | 13600                                   | 13400                           | 4.32      |
| 95              | Winona C. & C. Co. No. 2. | Taylor      | L. Kitt'ing, Min. sect. | A. R.                | 1.53       | 30.60            | 57.23         | 0.019       | 10.84 | 2.56     | 73.63     | 4.88      | 7.07    | 1.22                                   | 13500                                   | 13300                           | 4.21      |
| 96              | Harvey Phillips           | Barbour     | L. Kitt'ing, Min. sect. | A. R.                | 0.76       | 31.49            | 62.43         | 0.012       | 5.32  | 1.46     | 81.78     | 5.05      | 5.07    | 1.32                                   | 14870                                   | 14700                           | 4.16      |
| 97              | Sterling Coal Co.         | Taylor      | L. Kitt'ing, Min. sect. | A. D.                | 0.95       | 29.21            | 60.91         | 0.008       | 8.93  | 3.38     | 77.77     | 4.94      | 3.96    | 1.02                                   | 14324                                   | 14202                           | 6.03      |
| 97              | Sterling Coal Co.         | Taylor      | L. Kitt'ing, Min. sect. | A. R.                | 1.47       | 29.06            | 60.58         | 0.008       | 8.89  | 3.36     | 77.37     | 5.00      | 4.37    | 1.01                                   | 14250                                   | 14152                           | 5.83      |
| 98              | Overholt C. & C. Co.      | Taylor      | L. Kitt'ing, Min. sect. | A. D.                | 0.44       | 31.82            | 58.27         | 0.021       | 9.47  | 1.94     | 75.80     | 4.97      | 6.54    | 1.28                                   | 13930                                   | 13680                           | 4.71      |
| 98              | Overholt C. & C. Co.      | Taylor      | L. Kitt'ing, Min. sect. | A. R.                | 10.52      | 28.60            | 52.37         | 0.021       | 8.51  | 1.74     | 68.12     | 5.60      | 14.88   | 1.15                                   | 12520                                   | 12290                           | 2.93      |
|                 | Average                   |             | L. Kitt'ing, Min. sect. | A. D.                | 0.73       | 30.62            | 58.95         | 0.016       | 9.70  | 2.63     | 75.92     | 4.92      | 5.65    | 1.18                                   | 13955                                   | 13761                           | 4.95      |
|                 | Average                   |             | L. Kitt'ing, Min. sect. | A. R.                | 2.20       | 30.84            | 56.78         | 0.020       | 10.18 | 2.84     | 73.97     | 4.98      | 7.14    | 1.19                                   | 13543                                   | 13395                           | 4.27      |
|                 | Average                   | Marion      | L. Kitt'ing, Cannel.    | A. R.                | 0.53       | 26.34            | 44.43         | 0.047       | 28.70 | 1.33     | 59.86     | 4.19      | 4.93    | 0.99                                   | 11010                                   | 10475                           | 1.79      |
| 99              | Z. Gibson                 | Preston     | Clarion, Min. sect.     | A. R.                | 0.85       | 28.64            | 59.63         | 0.044       | 10.88 | 3.27     | 74.73     | 4.89      | 6.10    | 1.13                                   | 13800                                   | 13640                           | 4.69      |
| 100             | Jacob Keys                | Monongalia. | U. Mercer, Min. sect.   | A. R.                | 1.88       | 24.61            | 51.34         | 0.023       | 22.17 | 10.72    | 64.13     | 3.79      | 8.20    | 0.98                                   | 11160                                   | 1080                            | 2.11      |
| 101             | B. & N. R. R.             | Taylor      | U. Mercer, U. bench.    | A. R.                | 0.92       | 30.59            | 62.75         | 0.008       | 5.74  | 1.46     | 77.99     | 4.99      | 8.51    | 1.31                                   | 14320                                   | 13840                           | 5.47      |
| 101             | B. & N. R. R.             | Taylor      | U. Mercer, L. bench.    | A. R.                | 1.15       | 27.00            | 54.56         | 0.012       | 17.49 | 0.69     | 68.16     | 4.23      | 8.30    | 1.13                                   | 12240                                   | 11920                           | 2.64      |

**Page Reference to Detailed Description and Section of Coal  
Mines Listed in Preceding Table.**

| Map No. | Laboratory No.       | Name of Owner.   | Page of this Report. |
|---------|----------------------|--|----------------------|
| 1       | 597-H                | Lewis Lemley.....  | 179                  |
| 2       | 598-H                | Levi White.....  | 184-5                |
| 3       | 600-H                | Crop, public road.....                                     | 190-1                |
| 4       | 614-H                | Geo. C. Wright.....  | 202                  |
| 5       | 643-H                | Unknown.....   | 205                  |
| 6       | 644-H                | Crop, public road.....                                     | 211                  |
| 7       | 618-H                | Clark Wade.....  | 234                  |
| 7A      | 816-H                | Chas. Brand.....   | 235                  |
| 8       | 620-H                | Wm. Glasscock.....   | 239                  |
| 9       | 613-H                | John Statler.....  | 240                  |
| 10      | 647-H                | C. J. Martin.....  | 240                  |
| 11      | 649-H                | Monongahela Valley Traction Company.....                   | 242                  |
| 12      | 642-H                | W. I. Nutter.....  | 245                  |
| 13      | 641-H                | Baltimore & Ohio Railroad.....                             | 253-4                |
| *20     | 596-H                | T. W. Kinnan.....  | 432                  |
| 14      | 631-H                | S. Z. T. Martin.....                                       | 736                  |
| 15      | 721-H                | Parker Run Coal & Coke Co.....                             | 661                  |
| 15A     | 444-H                | Dakota Coal & Coke Co.....                                 | 661                  |
| 15B     | 815-H                | A. H. Tait.....  | 262                  |
| *20     | 595-H                | T. W. Kinnan.....  | 432                  |
| 16      | 635-H                | Wm. Robinson.....  | 680                  |
| 17      | Vol. II(A)<br>p. 668 | Elkins Coal & Coke Co. No. 5.....                          | 680                  |
| 18      | 735-H                | Great Scott Coal & Coke Co.....                            | 680                  |
| 19      | 737-H                | Antler Coal Co.....  | 681                  |
| 20      | 734-H                | Consolidation Coal Co. No. 30 (Beechwood).....             | 681                  |
| 21      | 732-H                | Pittsburgh Steam Coal Co.....                              | 682                  |
| 22      | 731-H                | Consolidation Coal Co. No. 45 (Murray).....                | 682                  |
| 23      | 730-H                | Catawba Coal Co.....                                       | 683                  |
| 24      | 729-H                | Pittsburgh Steam Coal Co.....                              | 683                  |
| 25      | 728-H                | Virginia & Pittsburgh Coal & Coke Co. }<br>(Morgan).....   | 684<br>(711)         |
| 26      | 727-H                | Consolidation Coal Co. No. 24 (Montana).....               | 684                  |
| 27      | 441-H                | Federal Coal & Coke Co.....                                | 685                  |
| 28      | 443-H                | New Central Coal Co.....                                   | 685                  |
| 29      | 720-H                | Dakota Coal & Coke Co.....                                 | 686                  |
| 30      | 723-H                | Jamison Coal & Coke Co. No. 9.....                         | 686-7                |
| 31      | 715-H                | Jamison Coal & Coke Co. No. 8.....                         | 687-8                |
| 32      | 725-H                | Jamison Coal & Coke Co. No. 7.....                         | 688                  |
| 33      | 722-H                | Consolidation Coal Co. No. 38 (Shaft).....                 | 690                  |
| 34      | 445-H                | Pat Hoge.....  | 691                  |
| 35      | 702-H                | Consolidation Coal Co. No. 56 (Gaston).....                | 691                  |
| 36      | 719-H                | Consolidation Coal Co. No. 26 (New England).....           | 691                  |
| 37      | 718-H                | Robinson Bros.....   | 692                  |
| 38      | 714-H                | Virginia & Pittsburgh Coal & Coke Co. (King-<br>mont)..... | 692                  |
| 39      | 717-H                | Phillips Coal Co.....                                      | 693                  |
| 40      | 698-H                | Consolidation Coal Co. No. 43 (Monongah<br>No. 6).....     | 694                  |

\*Well number.

| Map No. | Laboratory No.               | Name of Owner.                                      | Page of this Report. |
|---------|------------------------------|---|----------------------|
| 41      | 701-H                        | Consolidation Coal Co. No. 22 (Monongah No. 7)..... | 694                  |
| 42      | 700-H                        | Consolidation Coal Co. No. 22 (Monongah No. 5)..... | 695                  |
| 43      | 699-H                        | Consolidation Coal Co. No. 53 (Shaver)....          | 695                  |
| 44      | 695-H                        | Consolidation Coal Co. No. 63 (Monongah No. 8)..... | 696                  |
| 45      | 694-H                        | Consolidation Coal Co. No. 34 (Monongah No. 3)..... | 696                  |
| 46      | 693-H                        | Consolidation Coal Co. No. 68 (Pennois)....         | 697                  |
| 47      | 711-H                        | Harry B. Clark Coal Co. No. 6.....                  | 698                  |
| 48      | 709-H                        | Harry B. Clark Coal Co. No. 3.....                  | 698                  |
| 49      | 710-H                        | Harry B. Clark Coal Co. No. 2.....                  | 698                  |
| 50      | 708-H                        | Kilarm Coal & Coke Co. No. 2.....                   | 699                  |
| 51      | 707-H                        | Kilarm Coal & Coke Co. No. 1.....                   | 699                  |
| 52      | 692-H                        | Consolidation Coal Co. No. 59 (Anderson) ...        | 700                  |
| 53      | 691-H                        | Consolidation Coal Co. No. 36 (Highland) ...        | 700                  |
| 54      | 690-H                        | Consolidation Coal Co. No. 47 (Middleton) ...       | 701                  |
| 55      | 689-H                        | Consolidation Coal Co. No. 28 (Chiefton) ...        | 701                  |
| 56      | 688-H                        | Consolidation Coal Co. No. 34 (Paradise) ...        | 702                  |
| 57      | 687-H                        | Consolidation Coal Co. No. 67 (Hutchinson) ..       | 702                  |
| 58      | 703-H                        | Four States Coal & Coke Co. (Annabelle) ..          | 703-4                |
| 59      | 676-H                        | Harrison Coal Co.....                               | 705                  |
| 60      | 677-H                        | Rosemont Coal Co.....                               | 705                  |
| 61      | 678-H                        | Pittsvein Coal Co.....                              | 706                  |
| 62      | 679-H                        | T. B. Davis Mine.....                               | 706                  |
| 63      | 684-H                        | McGraw Coal Co. (New York).....                     | 707                  |
| 64      | 683-H                        | Grafton Coal & Coke Co.....                         | 707                  |
| 65      | 680-H                        | Maryland Coal Co. of W. Va. (Wendel No. 4) ..       | 708                  |
| 66      | 681-H                        | Maryland Coal Co. of W. Va. (Wendel No. 1) ..       | 708                  |
| 67      | 682-H                        | Maryland Coal Co. of W. Va. (Wendel No. 5) ..       | 708                  |
| 68      | 686-H                        | John Robinson (Kunst).....                          | 709                  |
| 69      | 563-H                        | Crop, public road.....                              | 277                  |
| 69A     | 814-H                        | Regal Coal Co.....                                  | 284                  |
| 70      | 581-H                        | John Williams.....                                  | 304                  |
| 71      | 574-H                        | J. J. Shroyer.....                                  | 303                  |
| 72      | 572-H                        | Crop, public road.....                              | 315                  |
| 73      | 636-H                        | Chess Estate .....                                  | 714                  |
| 74      | Bull. 2<br>p. 298<br>Bull. 2 | Elkins Coal & Coke Co. No. 1 (Richard)....          | 714                  |
| 75      | p. 298                       | Connellsville Basin Coke Co.....                    | 716                  |
| 76      | 650-H                        | Terence Stewart .....                               | 716                  |
| 77      | 655-H                        | Baldwin Weaver .....                                | 717                  |
| 78      | 656-H                        | O. C. Johnson.....                                  | 717                  |
| 79      | 629-H                        | Daniel Morris .....                                 | 717                  |
| 80      | 585-H                        | U. G. Jennings.....                                 | 718                  |
| 81      | 576-H                        | Edith J. Harvey.....                                | 718                  |
| 82      | 658-H                        | Emory Jones.....                                    | 338                  |
| 83      | 603-H                        | W. A. C. Carrothers.....                            | 343                  |
| 84      | 713-H                        | Winona Coal & Coke Co. No. 1.....                   | 721                  |
| 85      | 571-H                        | C. N. Mason.....                                    | 341                  |
| 86      | 632-H                        | J. H. McClaren.....                                 | 744                  |

| Map No. | Laboratory No. | Name of Owner.                      | Page of this Report. |
|---------|----------------|-------------------------------------|----------------------|
| 87      | 626-H          | Joseph Reppert .....                | 350                  |
| 88      | 579-H          | Unknown .....                       | 350                  |
| 89      | 651-H          | Samuel Frederick .....              | 351                  |
| 90      | 625-H          | Marcellus Jolliffe .....            | 353                  |
| 91      | 624-H          | Owen Vincent .....                  | 356                  |
| 92      | 610-H          | Jacob Rogers .....                  | 355                  |
| 93      | 627-H          | Jacob Rogers .....                  | 356                  |
| 94      | 602-H          | Charles Sapp .....                  | 359                  |
| 95      | 712-H          | Winona Coal & Coke Co. No. 2.....   | 726                  |
| 96      | 575-H          | Harvey Phillips .....               | 358                  |
|         | Vol. II(A)     |                                     |                      |
| 97      | p. 514         | Sterling Coal Co.....               | 726                  |
| 98      | 685-H          | Overholt Coal & Coke Co.....        | 727                  |
| 99      | 634-H          | Z. Gibson .....                     | 362                  |
| 100     | 652-H          | Jacob Keys .....                    | 373                  |
| 101     | 606-H          | Buckhannon & Northern Railroad..... | 376                  |

## CHAPTER XIII.

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### CLAY, ROAD MATERIAL, SAND, BUILDING STONE, IRON ORE, WATER POWER RESOURCES AND FORESTS.

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#### CLAY.

An exhaustive discussion of the clay industry of the State is given in Vol. III. of the State Geological Survey Reports by G. P. Grimsley, to which reference is made for a full account of the origin, physical and chemical properties, and the uses of clay.

#### *Present Development.*

##### Potteries.

The **Willetts Company** at Fairmont and the **Homewood Pottery Company** at Mannington are the only potteries located in the territory of this report. The clay used in both plants comes from other States and from Europe. Both plants have been described in Chapter I.

##### Brick Plants.

**The Morgantown Brick Company.**—This company, which is located near the northern limit of the city of Morgantown, is mentioned briefly in Chapter I and is described in detail on page 234 of Vol. III. of the State Survey Reports. The product consists of building and paving brick. The material used is quarried from the Pittsburgh Red Shale of the Cone-maugh Series, of which the supply is sufficient for many years. A section made at the quarry in 1911 shows the following succession in descending order:

|   | Thickness. | Total. |
|---|------------|--------|
|   | Feet.      | Feet.  |
| 1. Shale, red and variegated.....       | 30         | 30     |
| 2. Shale, blue, soft.....               | 20         | 50     |
| 3. Limestone, silicious .....           | 2          | 52     |
| 4. Shale, hard, blue .....              | 15         | 67     |
| 5. Limestone, hard, to R. R. grade..... | 4          | 71     |
| 6. Concealed to river .....             | 20         | 91     |

For building brick everything is used from Nos. 1, 2 and 4. For paving brick Nos. 2 and 4 are used. The brick burns to a dark red color. A mechanical test of the paving brick of this company was made by Messrs. Crawford, Bromley and Gaskins at the Mechanical Laboratory of the West Virginia University in 1911 as follows:

| Kind of Brick.     | Transverse strength, lbs. per sq. inch. | Crushing Strength, lbs. per sq. inch. | Rattler Test, per cent of loss after 1800 revs. | Absorption. Per cent. |
|--------------------|---|---------------------------------------|---|-----------------------|
| Repressed .....    | 1842                                    | 6497                                  | 44.3  | ....                  |
| Wire cut .....     | 1895                                    | 7840                                  | ....  | ....                  |
| Grooved Paving.... | 1917                                    | 6332                                  | 33.7  | 2.25                  |

The results show that the brick is excellent for paving purposes.

The same company formerly operated a plant on the west side of the Monongahela river here when building brick was made from Monongahela river clay. A large portion of the property of the company was recently condemned for railroad purposes and the west side plant is not now in operation.

**The Empire Brick Company.**—This plant is located on the B. & O. R. R. at Star City and its output consists of building brick. There are 4 rectangular, gas-burning kilns. The plant is not in operation. A section made at the shale quarry shows the following:

|   | Feet. |
|---|-------|
| 1. Concealed .....  |       |
| 2. Shale, black, Little Clarksburg coal horizon.....  | 3     |
| 3. Limestone, dark gray, slightly ferriferous and containing fresh water fossils, Clarkeburg..... | 6     |
| 4. Shale, red and variegated, to bottom of pit, Clarksburg .....                                  | 25    |

**Hutchinson and Barnes Brick Company.**—This plant which has its office at Fairmont and works near the northern limits of the same city has been making brick for nearly forty

years, but has operated under the present management since 1900. The product consists of building brick, with a daily capacity of 30,000 and output of 18,000. The equipment includes a Hercules soft mud machine, a tunnel drier and four rectangular up-draft kilns using natural gas fuel. The bricks burn red, and 9 men are employed.

The raw material is quarried from an extensive deposit of river clay of Quaternary age. A section in descending order shows the following:

|                                      | Feet. Inches. |   |
|--------------------------------------|---------------|---|
| 1. Sand, limy .....                  | 4             | 0 |
| 2. Clay, bluish gray.....            | 12            | 0 |
| 3. Clay, white, very hard.....       | 0             | 1 |
| 4. Clay, bluish gray, to bottom..... | 8             | 0 |

A sample collected for analysis by Reger from Nos. 1 to 4 inclusive, shows the following results according to Messrs. Hite and Krak:

|   | Per cent.     |
|---|---------------|
| Silica (Si O <sub>2</sub> ).....                      | 68.94         |
| Ferric Iron (Fe <sub>2</sub> O <sub>3</sub> ).....    | 6.32          |
| Alumina (Al <sub>2</sub> O <sub>3</sub> ).....        | 13.53         |
| Lime (Ca O).....                                      | 0.36          |
| Magnesia (Mg O).....                                  | 0.95          |
| Sodium (Na <sub>2</sub> O).....                       | 0.62          |
| Potassium (K <sub>2</sub> O).....                     | 1.91          |
| Titanium (Ti O <sub>2</sub> ).....                    | 0.35          |
| Phosphoric Acid (P <sub>2</sub> O <sub>5</sub> )..... | 0.22          |
| Moisture .....  | 1.13          |
| Loss on ignition.....                                 | 5.72          |
| <b>Total .....</b>                                    | <b>100.05</b> |

According to T. J. Mason, Superintendent, the best results are obtained by mixing the different strata, although No. 3 is often rejected, owing to its hardness.

**United States Sewer Pipe Company.**—This company, having its main office in the Frick Building, Pittsburgh, Pa., operates a brick plant at Annabelle, Marion county. The plant, which was established in 1910, makes building brick. There is an automatic wire-cutting machine of 50,000 capacity, two 9-foot dry pans and four up-draft rectangular kilns of 20,000 capacity each, coal being used for fuel. According to James G. Renehan, Superintendent, the plant employs 47 men.

The raw material is quarried from the **Annabelle shale** of the Monongahela Series. A section made in descending order at the shale quarry shows the following, according to Reger:

|   | Thickness.<br>Feet. | Total.<br>Feet. |
|---|---------------------|-----------------|
| 1. Clay soil .....                            | 4                   | 4               |
| 2. Shale, gray .....                          | 4                   | 8               |
| 3. Slate, black, 0' 3".....                   | 0                   | 8               |
| 4. Shale, greenish brown.....                 | 12                  | 20              |
| 5. Sandstone, massive, Uniontown.....         | 15                  | 35              |
| 6. Shale, gray, very silicious and hard.....  | 8                   | 43              |
| 7. Sandstone, massive .....                   | 4                   | 47              |
| 8. Shale, gray and hard to bed of quarry..... | 6                   | 53              |
| 9. Shale .....                                | 5                   | 58              |
| 10. Coal, Uniontown .....                     | 1                   | 59              |
| 11. Shale, silicious, to run.....             | 10                  | 69              |

The bricks are made from Nos 1, 2, 4, 6 and 8 of section and burn to a pale red color. A sample collected from these numbers gives the following analysis according to Messrs Hite and Krak:

|   | Per cent. |
|---|-----------|
| Silica (Si O <sub>2</sub> ) .....                     | 54.83     |
| Ferric Iron (Fe <sub>2</sub> O <sub>3</sub> ).....    | 7.43      |
| Alumina (Al <sub>2</sub> O <sub>3</sub> ) .....       | 20.45     |
| Lime (Ca O).....                                      | 1.78      |
| Magnesia (Mg O).....                                  | 1.55      |
| Sodium (Na <sub>2</sub> O) .....                      | 0.66      |
| Potassium (K <sub>2</sub> O) .....                    | 3.35      |
| Titanium (Ti O <sub>2</sub> ).....                    | 0.29      |
| Phosphoric Acid (P <sub>2</sub> O <sub>5</sub> )..... | 0.59      |
| Moisture .....  | 1.28      |
| Loss on ignition.....                                 | 8.34      |

Total ..... 100.55

The analysis shows that the material is well adapted for building and paving brick.

**Colfax Brick Company.**—This plant, which is located at Colfax, Marion county, on the main line of the B. & O. Railroad, makes building brick. It was described briefly by G. P. Grimsley in Vol. III. of the Survey Reports, page 274. According to J. L. Johnson, Manager, the company now employs 20 men and makes about 16,000 brick daily. A section made by Reger at the quarry shows the following:

|   | Feet. |
|---|-------|
| 1. Sandy clay .....                     | 12    |
| 2. Sand, gray, with river boulders..... | 4     |
| 3. Shale, variegated, Thornton.....     | 25    |
| 4. Coal, Upper Freeport.....            | 3     |

The brick is made by mixing the river clay, No. 1 of section, with the Thornton shale and burns red. According to Mr. Johnson, the Thornton shale makes a fair grade of brick



when used alone. A sample collected from No. 3 of section shows the following analysis according to Messrs. Hite and Krak:

|   | Per cent. |
|---|-----------|
| Silica (Si O <sub>2</sub> ) .....                     | 61.56     |
| Ferric Iron (Fe <sub>2</sub> O <sub>3</sub> ).....    | 7.14      |
| Alumina (Al <sub>2</sub> O <sub>3</sub> ) .....       | 19.69     |
| Lime (Ca O).....                                      | 0.61      |
| Magnesia (Mg O),.....                                 | 1.42      |
| Sodium (Na <sub>2</sub> O) .....                      | 0.54      |
| Potassium (K <sub>2</sub> O) .....                    | 3.19      |
| Titanium (Ti O <sub>2</sub> ).....                    | 0.34      |
| Phosphoric Acid (P <sub>2</sub> O <sub>5</sub> )..... | 0.34      |
| Moisture .....  | 0.31      |
| Loss on ignition.....                                 | 5.10      |
| Total .....   | 100.24    |

A test of brick from this plant, made by G. P. Grimsley under date of Jan. 12, 1906, shows the following results:

**Rattler Test**—Twelve square-cornered bricks used at each test; first weight, 65½ lbs.

Weight at end of 600 revolutions, 57¾ lbs.; loss, 11.83 per cent.

Weight at end of 1200 revolutions, 55½ lbs.; loss 15.27 per cent.

Weight at end of 1800 revolutions, 53 lbs.; loss, 19.09 per cent.

Crushing strength, 10,380 lbs. per sq. in.; transverse strength, 1870 lbs. per sq. in.; absorption, 5.8 per cent.

The test shows that the brick is well adapted for building purposes.

**Hammond Fire Brick Company.**—This plant, which is located at Hammond, Marion county, on the main line of the B. & O. Railroad, has been fully described by G. P. Grimsley in Vol. III., pages 220-222. Detailed studies in connection with the present report, however, show conclusively that the fire clay horizon referred to by Dr. Grimsley as the Lower Kittanning, belongs undoubtedly in the Pottsville series of rocks just above the Upper Mercer coal. Its position in the measures under the name of the Hammond Fire Clay may be seen by reference to the geologic section for Powell in Chapter IV.

**Thornton Fire Brick Company.**—This plant, which is located at Thornton, Taylor county, on the B. & O. Railroad, was described by G. P. Grimsley in Vol. III., pages 223-224. According to G. L. Rogers and J. S. McCann, ceramic engineers now in charge of the plant, the output consists of pav-

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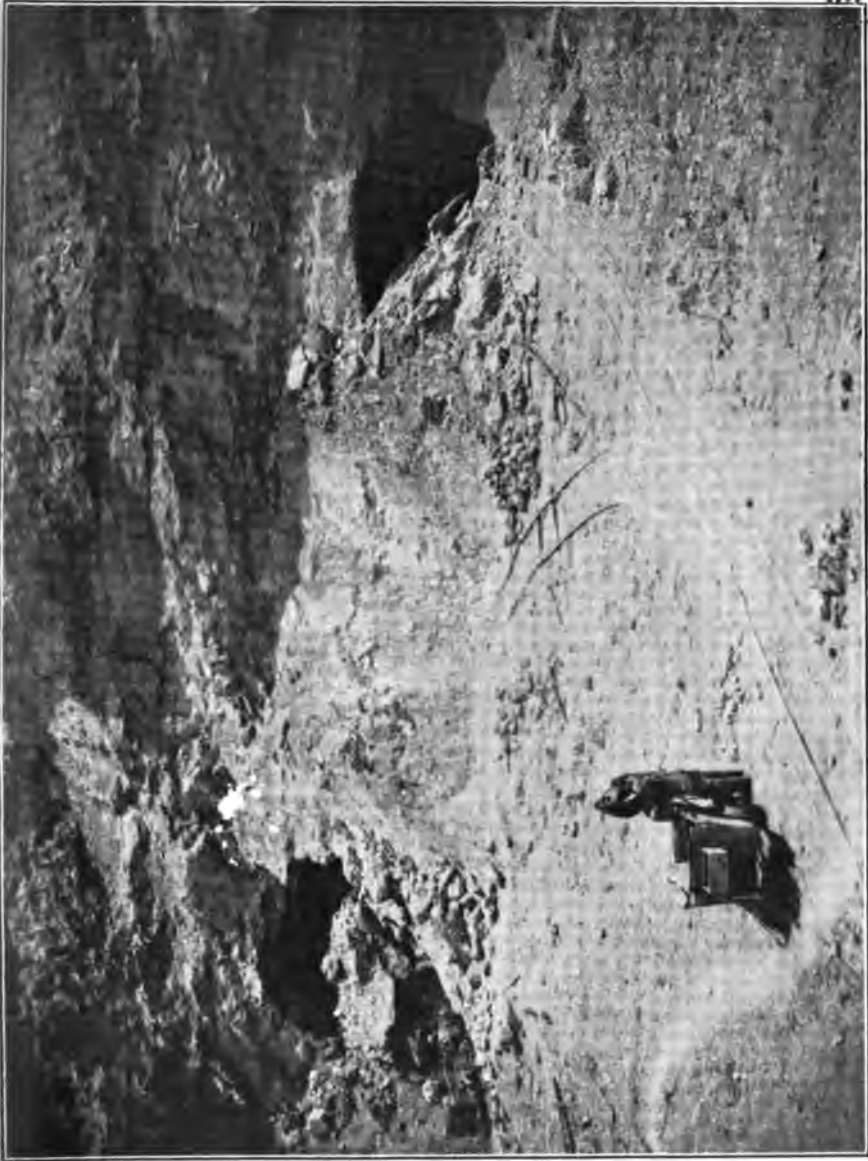


PLATE XXXII.—Combination quarry and mine in the Thornton fire clay, Thornton, Brick Company. Thornton, Taylor County.





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ing block, paving brick, fire brick, tunnel brick and ground fire clay. Owing to lack of kiln capacity very little fire brick is made. The daily capacity is 60,000 and 50 men are employed.

A section made at the clay mine by Reger shows the following:

|   | Feet.              |
|---|--------------------|
| 1. Sandstone, massive, Mahoning.....                      | 22                 |
| 2. Fire clay shale, brown.....16'                         | } Thornton..... 52 |
| 3. Fire clay shale, gray, with<br>flinty deposits.....36' |                    |
| 4. Coal, Upper Freeport.....                              |                    |
| 5. Fire clay, gray, Bolivar.....                          | 2.7                |
| 6. Concealed .....  | 12                 |
| 7. Shale, gray, silicious and micaceous.....              | 25                 |
| 8. Limestone, silicious, Upper Freeport.....              | 3                  |
| 9. Shale, gray, with limestone nuggets.....               | 10                 |

Nos. 2 and 3 of section are used for brick, being usually mined together and mixed half-in-half. Nos. 7 and 9 have also been mined extensively, but have too much lime for convenient operation. The mixture burns to a buff color. Samples collected from Nos. 2 and 3 of section show the following analyses according to Messrs. Hite and Krak:

|   | Brown Shale,<br>No. 2 | Fire Clay,<br>No. 3 |
|---|-----------------------|---------------------|
|   | Per cent.             | Per cent.           |
| Silica (Si O <sub>2</sub> ).....                      | 65.01                 | 64.19               |
| Ferric Iron (Fe <sub>2</sub> O <sub>3</sub> ).....    | 5.38                  | 4.32                |
| Alumina (Al <sub>2</sub> O <sub>3</sub> ) .....       | 17.96                 | 20.66               |
| Lime (Ca O) .....                                     | 0.66                  | 0.55                |
| Magnesia (Mg O).....                                  | 1.00                  | 0.53                |
| Sodium (Na <sub>2</sub> O) .....                      | 0.19                  | 0.64                |
| Potassium (K <sub>2</sub> O) .....                    | 3.00                  | 2.82                |
| Titanium (Ti O <sub>2</sub> ).....                    | 0.63                  | 0.52                |
| Phosphoric Acid (P <sub>2</sub> O <sub>5</sub> )..... | 0.23                  | 0.22                |
| Moisture .....  | 0.96                  | 1.05                |
| Loss on ignition.....                                 | 5.19                  | 5.08                |
| <b>Total .....</b>                                    | <b>100.21</b>         | <b>100.58</b>       |

The deposits of flint clay contained in No. 3 of section, as analyzed separately in Vol. III., page 224, show a much higher refractory character than the analyses here given. This feature makes necessary a careful selection of clay for the various uses to which it is put.

Mr. D. R. Potter, general manager of the Thornton Company, has furnished the Survey the following tests of Thornton brick:

**Report of Tests of Paving Block Made for Thornton Fire Brick Company, June 2, 1911, by Pittsburgh Testing Laboratory.**

| Lab. No. | Mark. | Dimensions. Inches. | Area. | Load.        | Crushing Strength per sq. in. |
|----------|-------|---------------------|-------|--------------|-------------------------------|
| 33137    | B.7   | 3.80x3.00x3.80      | 11.40 | 160,100 lbs. | 14,030 lbs.                   |
| 33138    | 8     | 3.85x3.00x3.80      | 11.55 | 118,300 lbs. | 10,240 lbs.                   |
| 33139    | N.B   | 2.90x2.86x3.76      | 11.15 | 134,000 lbs. | 12,020 lbs.                   |

**Report of Tests of Tunnel Block Made for the Thornton Fire Brick Company, July 5, 1911, by Pittsburgh Testing Laboratory.**

| Lab. No. | Mark. | Dimensions. Inches. | Area. | Load.       | Crushing Strength per sq. in. |
|----------|-------|---------------------|-------|-------------|-------------------------------|
| 33320    | No. 1 | 3.50x3.02x3.80      | 10.57 | 85,350 lbs. | 8,075 lbs.                    |
| 33321    | No. 2 | 3.45x3.00x3.80      | 10.35 | 95,450 lbs. | 9,223 lbs.                    |
| 33322    | No. 3 | 3.50x3.04x3.72      | 10.64 | 96,000 lbs. | 9,022 lbs.                    |
| 33323    | No. 4 | 3.50x3.10x3.70      | 10.85 | 82,000 lbs. | 7,558 lbs.                    |
| 33324    | No. 5 | 3.50x3.00x3.84      | 10.50 | 76,000 lbs. | 7,238 lbs.                    |
| 33325    | No. 6 | 3.12x3.08x3.90      | 9.61  | 57,100 lbs. | 5,942 lbs.                    |

One-half block crushed on edge.

Collins P. Bliss, Director of the Testing Laboratory of the New York University, reports the following test of Thornton brick:

"The loss on the abrasion test was only 14.32; the transverse test showed a strength of 2370 lbs. per sq. in.; the specific gravity was 2.34, and the absorption, 2.22 per cent after 48 hours' drying and 48 hours' soaking of specimens that had already passed through the rattler."

Prof. Edward Orton, Jr., of the Ohio State University, reported the following rattler test of Thornton brick made according to the specifications of the National Brick Manufacturer's Association, under date of March 18, 1907:

|   | First Charge. | Second Charge. |
|---|---------------|----------------|
| Initial weight of 10 bricks.....            | 104.0 lbs.    | 101.5 lbs.     |
| Weight of same after 1800 revolutions ..... | 87.4 lbs.     | 84.5 lbs.      |
| Loss by rattling .....                      | 16.6 lbs.     | 17.0 lbs.      |
| Percentage loss .....                       | 15.96 lbs.    | 16.75 lbs.     |

Average percentage loss for both charges, 16.35. No bricks broken.

*Available Clay*

The transported clays of the territory of this report may be classed under two heads; viz., the recent or river clays that are to be found in great abundance along the larger streams, and the Pleistocene clays that were deposited during the Glacial Epoch along the Monongahela Valley and that, so far as observed, do not appear at a level higher than 1060' above tide. In Monongalia county there are large deposits of river clay along Dunkard creek that probably contain sufficient plastic substance to make them available for building brick. In the J. O. and E. Price oil test well, 1½ miles east of Pentress, 58 feet of quicksand was reported, which probably represents the maximum thickness of river clay in the Dunkard valley. River deposits usually vary greatly in their character and money may be safely spent in the erection of a brick plant only after careful investigation of the clay.

On the Monongahela river, between Morgantown and the Pennsylvania line there are large deposits of river clay that offer favorable opportunity for brick manufacture. These deposits have been worked successfully at Morgantown.

On the Tygart Valley river in Taylor county, near Fetterman, there are deposits of clay that were formerly used for brick, that are still available.

The Pleistocene deposits of the Monongahela Valley vary in thickness from 50 to 100 feet. They occur in great abundance at Morgantown and at the junction of the West Fork and Tygart Valley rivers at Fairmont. They are usually too sandy to be classed as clay deposits. One mile northeast of Star City the following section, made with hand-level by Reger and arranged in descending order, shows the succession of the Pleistocene deposits:

|                          | Thickness. Total. |       |
|--------------------------|-------------------|-------|
|                          | Feet.             | Feet. |
| 1. Sand, loamy .....     | 24                | 24    |
| 2. Sand, moulder's ..... | 6                 | 30    |
| 3. Sand, good .....      | 8                 | 38    |
| 4. White clay, good..... | 26                | 64    |
| 5. River sand .....      | 18                | 82    |

(Elevation of base, 902' L.A.T.)

Two samples were collected for analysis from No. 4 of

section, one being taken from the upper portion while the other was from the lower 3 feet, which Messrs. Hite and Krak report as follows:

|   | Upper portion<br>of No. 4.<br>Per cent. | Lower 3 feet<br>of No. 4.<br>Per cent. |
|---|---|--|
| Silica (SiO <sub>2</sub> ).....                       | 62.96                                   | 66.50                                  |
| Ferric Iron (Fe <sub>2</sub> O <sub>3</sub> ).....    | 3.43                                    | 2.59                                   |
| Alumina (Al <sub>2</sub> O <sub>3</sub> ).....        | 21.11                                   | 19.47                                  |
| Lime (Ca O).....                                      | 0.12                                    | 0.38                                   |
| Magnesia (Mg O).....                                  | 0.79                                    | 0.62                                   |
| Sodium (Na <sub>2</sub> O).....                       | 0.82                                    | 0.29                                   |
| Potassium (K <sub>2</sub> O).....                     | 3.12                                    | 2.70                                   |
| Titanium (Ti O <sub>2</sub> ).....                    | 0.44                                    | 0.50                                   |
| Phosphoric Acid (P <sub>2</sub> O <sub>5</sub> )..... | 0.12                                    | 0.14                                   |
| Moisture.....   | 1.07                                    | 1.12                                   |
| Loss on ignition.....                                 | 6.13                                    | 5.42.                                  |
| <b>Total</b> .....                                    | <b>100.11</b>                           | <b>99.73</b>                           |

Mr. R. B. Reid operates an extensive stripping at this point mostly for sand, the plant being discussed under that head on a subsequent page. The analyses given above indicate that both samples would make a good grade of buff building brick, and also could be manufactured into drain and sewerage tile.

### Shale.

There is an abundance of excellent shale for brick making in every district of the three counties. The Washington fire clay shale, which occurs just below the Washington coal, the crop of which is shown on Map II., would provide material for brick wherever it is found. The Annabelle shale of the Monongahela Series and the Clarksburg red shale and Pittsburgh red shale of the Conemaugh series are widely distributed and are uniformly good both for building and paving brick. The two latter formations would be suitable for roofing tile. The Mauch Chunk red shale, often 300 feet thick at its crop along Cheat river and Decker's creek in Monongalia county, offers an unlimited amount of material suitable for brick. Dr. Heinrich Ries' gives the following analysis of Mauch Chunk shale from Decker's creek:

1. Clays, Their Occurrence, Properties and Uses, 1908, page 502.

|   | Per cent.    |
|---|--------------|
| Silica (Si O <sub>2</sub> ) .....                   | 56.30        |
| Alumina (Al <sub>2</sub> O <sub>3</sub> ) .....     | 19.07        |
| Ferric Oxide (Fe <sub>2</sub> O <sub>3</sub> )..... | 9.58         |
| Lime (Ca O).....                                    | 0.69         |
| Magnesium (Mg O).....                               | 2.01         |
| Titanic Oxide (Ti O <sub>2</sub> ).....             | 0.71         |
| Loss on ignition.....                               | 8.01         |
| <b>Total .....</b>                                  | <b>96.37</b> |

The large percentage of ferric oxide would insure the rich red color so often desired for building brick.

### Fire Clay.

In the territory of this report no fire clays of importance are found except in the lower portion of the Conemaugh and the Allegheny and Pottsville Series. Since these rocks do not crop west of the Monongahela river it will be useless to search for fire clay in that region. East of the Monongahela river, however, there is an abundance of outcropping fire clay of excellent quality. The principal fire clay horizons are the Thornton, Bolivar, Upper Kittanning, Hardman, Lower Kittanning, Mt. Savage and Hammond. They have all been described and analyses published in previous chapters. Since the samples for analyses were collected at the points of best development those localities are here referred to as the most likely prospects for their utilization.

## ROAD MATERIAL.

### *Limestone*

The principal limestones suitable for road-making in the territory of this report are contained in the Monongahela, Conemaugh, Allegheny and Greenbrier Series of rocks. Reference to Map II. will show where these series crop. While there are limestone members in the Dunkard Series they are too thin to be quarried economically for road material. The several limestones of the three series that contain them in



abundance have been described in previous chapters. Reference is here made to the Uniontown, Benwood, Sewickley, Upper and Lower Pittsburgh, Clarksburg, Elk Lick, Upper and Lower Freeport and Greenbrier limestones as the ones best suited for macadam. Their chemical composition is not important, but their ability to withstand weathering and abrasion and the thickness of the ledges and convenience of quarrying are the test of their worth.

### ***River and Creek Gravel***

There is an abundant supply of gravel in nearly all the stream beds that is available for road material. This gravel is, for the most part, composed of the more durable portion of the sandstone cliffs through which the streams have cut their way and for this reason is far superior in wearing qualities to the broken sandstone that is sometimes applied to roads. It requires only the labor needed to place it upon the roads and, when placed, is self-draining.

### ***Brick For Road Pavement***

Reference has previously been made in this chapter to the great amount of material available for the manufacture of paving brick. While brick paving heretofore has been for the most part confined to the cities, there is no reason why it should not be used for country roads where their improvement is desired. In nearly every magisterial district in the territory of this report there is plenty of material for brick as well as coal or gas with which to burn it. The use of brick for road paving would obviate the necessity of paying heavy freight charges on material shipped from distant points and would foster local brick-making and mining industries in a way that would be of great benefit to the communities where they would be located.

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PLATE XXXIII.—Quaternary sand deposit at the quarry of the North England Sand Company at Kingmont, Marion County.

## SAND BANKS.

### *Present Development*

**R. B. Reid Bank.**—This bank, which is located one mile northeast of Star City, has already been mentioned under the discussion of "Clay," where a section was given, showing the character of the deposits. The plant employs 3 men, but has a capacity of three carloads of sand daily when running full. Sand is furnished for building and foundry purposes, being used extensively in Morgantown. The sand is clean enough for ordinary use as it comes from the bank, but it is often run through a washer before being shipped. The sand belongs to the Pleistocene deposits previously mentioned, the amount available being enormous.

**New England Sand Company.**—This plant has its office at New England and works at Kingmont in Marion county. According to C. C. Durrett, Superintendent, the company was established in 1907 and supplies sand for the building trade. The capacity is 4 carloads daily, the average shipment being 2 carloads, 6 men being employed. The sand is dug from the hill east of Kingmont and conveyed through a sluice to the railroad, sufficient water being added at the mine to cause the sand to flow through the sluice. The sand is washed before shipment.

According to Reger, the deposit belongs in the Pleistocene or terrace formations which cover the low hills east of Kingmont with an elevation of 1045 feet above sea at the top and have a maximum observed thickness of 80 feet. The mine is in the top portion, the excavation being 25 feet deep. The sand contains no clay but has an abundance of river boulders or concretions that must be discarded.

**Lilley Sand Bank.**—This plant, which is located between Benton Ferry and Kingmont, was established in 1899 by George M. Lilley and furnishes sand for building purposes. The capacity is 2 carloads daily, 4 men being employed. The sand is conveyed through a gravity sluice to the railroad and is washed before shipment. Arch Lilley is authority for the foregoing data.

According to Reger, the sand is quarried from the same terrace deposits noted at the New England plant, the following section being made in descending order at the quarry:

|                              | Thickness. Total. |       |
|------------------------------|-------------------|-------|
|                              | Feet.             | Feet. |
| 1. Soil .....                | 2                 | 2     |
| 2. Sand, yellow .....        | 20                | 22    |
| 3. Iron ore, lenticular..... | 0.2               | 22.2  |
| 4. Clay, to bottom.....      | 1                 | 23.2  |

**Deckers Creek Stone and Sand Company.**—This plant, which is located at Sturgis, Monongalia county, on the Morgantown & Kingwood railroad, operates a large quarry for glass sand and sand for building purposes. The plant was fully described by G. P. Grimsley in Vol. IV., pages 388 and 515, to which reference is here made. In that report the horizon of the quarry was mentioned as the Homewood sandstone. Detailed studies published in Chapter IX. of this report, show conclusively that the quarry is in the Upper Connoquenessing sandstone which is the next sandstone below the Homewood member of the Pottsville Series. According to J. L. Mayfield, foreman, the present capacity of the plant is 150 tons daily.

**Columbia Tile Company.**—The Columbia Tile Company at its Grafton plant is making extensive use of glass sand in the manufacture of wall tile. The following valuable series of tests was made for the use of the Survey from tile made at this plant:

**ABSTRACT OF REPORT OF COMPARATIVE TESTS OF GLASS AND CLAY TILE**, for strength, adhesion and absorption with mortars and different kinds of cement, lime and plaster and different heat treatments by H. M. Leps, Consulting Mechanical Engineer, Grafton, W. Va., and John B. Grumbeln, Assistant Professor of Mechanical Engineering, West Virginia University, under the supervision of C. R. Jones, Dean of the College of Engineering, of the West Virginia University. The tests were made in the University Laboratories.

**Material Tested.**—1. 6" x 3" Opal Glass Tile, with undercut corrugations for holding tile to the setting mortar, manufactured by the Columbia Tile Company of Grafton, W. Va.

2. 6" x 3" Clay Tile, manufactured by four different companies, designated here as "A," "B," "C," and "D," made with varying proportions and forms of undercuts as indicated in table I.

3. The mortars used were of different proportions (weighed dry) of cement, lime, sand, and "Patent" wall plaster as indicated in tables by number. Two brands of cement were used—Atlas white cement, designated as "A," and Alpha Portland Cement, designated as

"M." The average tensile strength of the Alpha cement for specimens, 40 days old, was for neat cement 340 lbs. per sq. in. and for equal parts of sand and cement, 267 lbs. per sq. in. The sand used in all mixtures was white silica or glass sand, sharp, clean and dry and was passed through a No. 20 mesh sieve. The lime used was white building lime from near Martinsburg, W. Va. The wall plaster was supplied by the Fairmont Wall Plaster Co.

**Description of Tests.**—Specimens of the different tiles were taken, untreated in any way, for the transverse tests.

For the tests of strength of bond to wall, the glass and clay tiles were set on blocks of concrete  $1\frac{1}{2}$ " thick, 5" x 5" on one side, tapered to 5 x 6 on opposite side so that blocks could be held in a shackle. Two 6" x 3" tile were set on the 5" x 5" face of each block, giving the tile  $\frac{1}{2}$ " projection all round the block, so that by placing the bottom of block in shackle and resting the projection of tiles on a suitable support, the tile could be drawn from the setting in tension machine.

Identical mixtures of mortar were used in setting specimens of each tile and identification numbers cut in blocks as made. Treatment after setting was the same throughout.

The blocks on which the tiles were set were made of one part Portland cement to two parts sand with just sufficient water to enable the mixture to be moulded in a hinged form by ramming up and troweling, the surface becoming wet enough to smooth under the trowel, level with the top of form. The surface was immediately roughened by cross cutting with the edge of trowel, locating frame pinned in place and tile set at once. To set tile it was buttered smoothly on the back with setting mortar, placed on a wet roughened surface of block and settled into place with trowel handle used as a rammer. Clay tile was soaked in clear water over night before setting. Where lime was used it was slacked into a paste and added to the cement paste in proper proportion by weight.

**Treatment.**—After setting for twelve hours, blocks were moved to a platform in a damp cellar and sprinkled copiously with water and thereafter sprinkled until thoroughly wet, twice a day for twenty-one days, at which time the specimens subject to heat treatment were placed in a dry freezing can and subjected to a temperature of 18° for twenty-four hours, and then removed from the freezing can and placed in an ice chest without ice and allowed to come slowly to atmospheric temperature. These test blocks were then placed in glass tempering lehrs regulated to a temperature of 500° F. at which they remained for twelve hours. Temperature was then raised within thirty minutes to 1000° F. (approximate) remaining so for three hours. Fire was then turned off and blocks allowed to cool slowly to atmospheric temperature, and their condition noted. Table IV.

**Results of Tests.**—The most important deduction is that the strength of the bond between tile and wall is dependent on the strength of the setting mortar and the proportion of "undercut" or mechanical holding surface on the back of the tile. The strength of the setting mortars increased with the percentage of cement in the mixture. There was no chemical bond indicated between clay tile and setting mortar. Other results appear in the tables.

Table I. Dimensions and weight.

| Kind. | Designation. | Dimensions.<br>Inches. | Average<br>weight.<br>Ounces. | Undercut or<br>grips.<br>Per cent of area. |
|-------|--------------|------------------------|-------------------------------|--|
| Clay  | A            | 6x3x $\frac{3}{4}$ "   | 7.1                           | 3.3  |
| "     | B            | 6x3x $\frac{3}{4}$ "   | 7.1                           | 2.5  |
| "     | C            | 6x3x $\frac{1}{2}$ "   | 7.3                           | 4.7  |
| "     | D            | 6x3x $\frac{3}{4}$ "   | 7.1                           | 10   |
| Glass | Glass        | 6x3x $\frac{3}{4}$ "   | 8                             | 20.8                                       |

Table I(A). Setting Mortars.  
A—Atlas, and M—Alpha.

| Mixture<br>Number. | Kind of<br>Cement. | Cement<br>Parts. | Lime<br>Parts. | Sand<br>Parts. | Patent<br>Plaster<br>Parts. |   |
|--------------------|--------------------|------------------|----------------|----------------|-----------------------------|---|
| 1                  | A and M            | 1                | 0              | 2              | 0                           | Constituents of<br>Wall plaster<br>not given. |
| 2                  | " " "              | 1                | 0              | 3              | 0                           |   |
| 3                  | " " "              | 1                | 0              | 4              | 0                           |   |
| 4                  | " " "              | 1                | 1              | 3              | 0                           |   |
| 5                  | " " "              | 1                | 2              | 4              | 0                           |   |
| 6                  | A                  | 1                | 1              | 0              | 0                           |   |
| 7                  | A                  | 1                | 0              | 0              | 0                           |   |
| 8                  | A                  | 1                | 0              | 1              | 1                           |   |
| 9                  | P                  | 0                | 0              | 0              | 1                           |   |

Table II. Transverse Tests, Tile Laid on Wood Supports  $\frac{5}{2}$ " Between  
Centers, Load at Middle.

| Kind and Letter. | Thickness.<br>Inches. | Number of<br>tile tested. | Average<br>breaking<br>load, lbs. | Difference. | Per cent<br>excess glass<br>over clay. |
|------------------|-----------------------|---------------------------|-----------------------------------|-------------|--|
| Glass            | $\frac{3}{4}$         | 18                        | 268                               | ...         | ...                                    |
| Clay A           | $\frac{3}{4}$         | 7                         | 47                                | 221         | 470                                    |
| " B              | $\frac{3}{8}$         | 6                         | 127                               | 141         | 111                                    |
| " C              | $\frac{1}{2}$         | 5                         | 189                               | 79          | 41                                     |
| " D              | $\frac{3}{8}$         | 5                         | 81                                | 197         | 230                                    |

Table III. Data Sheet: Tension, Material, Test Blocks, Set With  
Glass and Clay Tile.Date Set: March 25th, 1913; Date Tested: May 1st, 1913; Age,  
37 Days.

| Mixture<br>No. | Cement<br>Kind | Tile<br>Kind | Number<br>blocks<br>tested | Average break-<br>ing load |                     | Character of break |        |      | Remarks.  |
|----------------|----------------|--------------|----------------------------|----------------------------|---------------------|--------------------|--------|------|---|
|                |                |              |                            | Total<br>lbs.              | Per sq.<br>in. lbs. | Bond               | Mortar | Tile |   |
| 1              | A              | Glass        | 8                          | 320                        | 12.8                | 0                  | .      | 4    | Area of<br>tile surface<br>in contact<br>with block<br>25 sq. in.<br>in all<br>cases. |
| 2              | A              | "            | 1                          | 180                        | 7.2                 | 0                  | 1      | 0    |   |
| 3              | A              | "            | 4                          | 173                        | 6.9                 | 0                  | 4      | 0    |   |
| 4              | A              | "            | 2                          | 268                        | 10.7                | 0                  | 2      | 1    |   |
| 5              | A              | "            | 3                          | 263                        | 10.5                | 0                  | 3      | 0    |   |
| 6              | A              | "            | 6                          | 302                        | 12                  | 0                  | 6      | 2    |   |
| 7              | A              | "            | 4                          | 478                        | 19                  | 0                  | 0      | 8    |   |
| 8              | A              | "            | 2                          | 213                        | 8.5                 | 0                  | 2      | 0    |   |
| 9              | P              | "            | 7                          | 275                        | 11                  | 0                  | 7      | 4    |   |

| Mixture No. | Cement Kind | Tile Kind | Number blocks tested | Average breaking load |                 | Character of break |        |      | Remarks. |
|-------------|-------------|-----------|----------------------|-----------------------|-----------------|--------------------|--------|------|----------|
|             |             |           |                      | Total lbs.            | Per sq in. lbs. | Bond               | Mortar | Tile |          |
| 1           | M           | "         | 3                    | 422                   | 17              | 0                  | 3      | 0    |          |
| 2           | M           | "         | 4                    | 180                   | 7.2             | 0                  | 4      | 0    |          |
| 3           | M           | "         | 2                    | 192                   | 7.7             | 0                  | 2      | 0    |          |
| 4           | M           | "         | 4                    | 196                   | 7.8             | 0                  | 4      | 0    |          |
| 5           | M           | "         | 4                    | 248                   | 9.8             | 0                  | 4      | 2    |          |
| 1           | A           | Clay      | 3                    | 208                   | 8.3             | 3                  | 3      | 2    |          |
| 2           | A           | "         | 4                    | 93.3                  | 3.7             | 4                  | 4      | 0    |          |
| 3           | A           | "         | 3                    | 98                    | 3.9             | 3                  | 3      | 0    |          |
| 4           | A           | "         | 4                    | 179                   | 7.0             | 4                  | 4      | 0    |          |
| 5           | A           | "         | 5                    | 119                   | 4.7             | 5                  | 3      | 0    |          |
| 6           | A           | "         | 7                    | 204                   | 8               | 5                  | 5      | 8    |          |
| 7           | A           | "         | 4                    | 344                   | 13.7            | 2                  | 0      | 7    |          |
| 1           | M           | Clay      | 2                    | 330                   | 13.2            | 2                  | 2      | 2    |          |
| 2           | M           | "         | 4                    | 136                   | 5.4             | 4                  | 2      | 1    |          |
| 3           | M           | "         | 3                    | 83                    | 3.3             | 3                  | 2      | 0    |          |
| 4           | M           | "         | 3                    | 113                   | 4.5             | 3                  | 3      | 0    |          |
| 5           | M           | "         | 3                    | 87                    | 3.4             | 3                  | 2      | 0    |          |

Values in column (7) represent number of blocks from which tile separated clean.

Column (8) number of blocks on which setting mortar broke.

Column (9) number of single tile broken.

Table III(A). Adhesion.

| Mixture No. | Cement | Breaking load per sq. in. |           | Difference | Per cent excess glass over clay. | Remarks.             |
|-------------|--------|---------------------------|-----------|------------|----------------------------------|----------------------|
|             |        | Glass lbs.                | Clay lbs. |            |                                  |                      |
| 1           | A      | 12.8                      | 8.3       | 4.5        | 55                               | Average 71 per cent. |
| 2           | A      | 7.2                       | 3.7       | 3.5        | 94                               |                      |
| 3           | A      | 6.9                       | 3.9       | 3.0        | 76                               |                      |
| 4           | A      | 10.7                      | 7         | 3.7        | 53                               |                      |
| 5           | A      | 10.5                      | 4.7       | 5.8        | 123                              |                      |
| 6           | A      | 12                        | 8         | 4          | 50                               |                      |
| 7           | A      | 19                        | 13.7      | 5.3        | 38                               |                      |
| 1           | M      | 18                        | 13.2      | 3.8        | 28                               | Average 91 per cent. |
| 2           | M      | 7.2                       | 5.4       | 1.8        | 33                               |                      |
| 3           | M      | 7.7                       | 3.3       | 4.4        | 133                              |                      |
| 4           | M      | 7.8                       | 4.5       | 3.3        | 73                               |                      |
| 5           | M      | 9.8                       | 3.4       | 6.4        | 191                              |                      |

Table III(B). Adhesion After Temperature Treatment.

| Mixture No. | Cement | Breaking load per sq. in. |           | Difference.                           | Per cent. excess. | Remarks.  |
|-------------|--------|---------------------------|-----------|---------------------------------------|-------------------|---|
|             |        | Glass lbs.                | Clay lbs. |                                       |                   |   |
| 1           | A      | 2                         | 2.4       |                                       |                   | All specimens in this test were frozen at 18° F. heated to 500° F. then to 1000° F. |
| 2           | A      | 2                         | 3         |                                       |                   |   |
| 3           | A      | ...                       | ...       |                                       |                   |   |
| 4           | A      | ...                       | ...       |                                       |                   |   |
| 5           | A      | 2.7                       | ...       |                                       |                   |   |
| 6           | A      | 1.4                       | ...       |                                       |                   |   |
| 7           | A      | 4.8                       | ...       |                                       |                   |   |
| 1           | M      | 1.8                       | ...       |                                       |                   |   |
| 2           | M      | ...                       | 0.2       |                                       |                   |   |
| 3           | M      | ...                       | 0.2       |                                       |                   |   |
| 4           | M      | 1.2                       | ...       |                                       |                   |   |
|             |        |                           |           | Results too irregular for comparison. |                   |   |



Table IV. Temperature.

Twenty-three test blocks set with glass tile and 13 blocks set with clay tile subjected to freezing at 18° F. for 24 hours and afterward heated up to 1000° F. (Approximate).

| GLASS.           |                                   |   |                   | CLAY.            |                                   |   |           |
|------------------|-----------------------------------|---|-------------------|------------------|-----------------------------------|---|-----------|
| No. of 6x3 tile. | Setting mortar broken No. Blocks. | Separated without breaking tile or mortar. No. tile | Crazed. No. tile. | No. of 6x3 tile. | Setting mortar broken No. Blocks. | Separated without breaking tile or mortar. No. tile | Crazed.   |
| 46               | 6                                 | 2   | 0                 | 26               | 0                                 | 11  | 14        |
| Per ct.          | 13.0 p. ct.                       | 4.3 p. ct.  |                   |                  |                                   | 42 p. ct.   | 54 p. ct. |

Table V. Absorption.

Twelve glass and 12 clay tile soaked in water for 12 hours, after drying in a temperature of 350° for six hours.

| Kind Tile.  | Average Weight dry. | Average Weight net. | Water Absorbed. | Per cent of dry weight. |
|-------------|---------------------|---------------------|-----------------|-------------------------|
|             | Grains.             | Grains.             | Grains.         |                         |
| Clay .....  | 3714                | 4185                | 411             | 11                      |
| Glass ..... | 4480                | 4480                | 000             | 00                      |

### Available Sand

The Pleistocene, or terrace deposits, of the Monongahela valley, already extensively developed, offer a large amount of sand for building purposes. Since the sand is loose, requiring no blasting, and the deposits are all convenient to railway transportation, it can be handled at a minimum cost. It is doubtful whether this sand should be used for concrete work without washing where strength of material is important, as the presence of a large amount of organic matter, such as the sand contains, would weaken the structure.

The only regions in the territory of this report where glass sand may be found are those in which the Pottsville series of rocks are above drainage, as the sandstones of all the other series are not chemically suitable. In the valley of Deckers creek, Monongalia county, these rocks are above drainage from Dellslow to Cascade and offer many suitable locations for quarries. In the Cheat river canyon the Potts-

ville series lies above drainage from Mont Chateau to the Preston county line, but lack of transportation prevents any present development. The Homewood sandstone of the Pottsville series crops in southeastern Clinton district, but here, also, transportation is lacking. In Marion county the Homewood and Connoquenessing sandstones both crop along the Tygart Valley river at Valley Falls, where quarries could easily be developed.

## BUILDING STONE.

### *Quarries*

In Vol. IV of the State Geological Survey Reports, G. P. Grimsley has described the following sandstone quarries located in the Monongalia-Marion-Taylor area:

| Quarry.                        | Sandstone Horizon.                  | Location.        | Page of Vol. IV. |
|--------------------------------|-------------------------------------|------------------|------------------|
| J. D. Charlton.....            | Mannington .....                    | Mannington ...   | 440              |
| A. R. Wilcox.....              | Waynesburg .....                    | Downs .....      | 449              |
| Georges Creek C. & C. Co. .... | Waynesburg .....                    | Underwood ...    | 449              |
| C. B. Conoway.....             | Waynesburg .....                    | Barrackville ... | 450              |
| Georges Creek C. & C. Co. .... | Gilboy .....                        | Underwood ...    | 452              |
| J. F. Watson.....              | Sewickley (Arnoldsburg) .....       | Fairmont .....   | 459              |
| George Lilley.....             | Pittsburgh .....                    | Fairmont .....   | 463              |
| J. F. Watson.....              | Upper Pittsburgh.....               | Fairmont .....   | 463              |
| W. B. Ice & Co.....            | Upper Pittsburgh.....               | Fairmont .....   | 464              |
| Wm. Cox.....                   | (Lower) Connellsville .....         | Morgantown ..    | 471              |
| Zevely & Casto.....            | Morgantown .....                    | Morgantown ...   | 477              |
| Wm. Gaston.....                | Morgantown .....                    | Morgantown ...   | 478              |
| Ramsey & Stark.....            | Buffalo .....                       | Fetterman .....  | 485              |
| Ramsey & Stark.....            | Buffalo .....                       | Fetterman .....  | 486              |
| W. A. Willhide.....            | Buffalo .....                       | Grafton .....    | 486              |
| Chas. Stozenfels.....          | Buffalo .....                       | Grafton .....    | 487              |
| John M. Keane.....             | Buffalo .....                       | Grafton .....    | 489              |
| — Christian .....              | Buffalo .....                       | Morgantown ...   | 490              |
| L. V. Keck.....                | Buffalo .....                       | Morgantown ...   | 491              |
| Sims & Co.....                 | Mahoning (Upper Freeport) .....     | Yates .....      | 495              |
| D. H. Going.....               | Homewood .....                      | Dellslow .....   | 514              |
| Deckers Creek Sand Co          | Homewood (Upper Connoquenessing) .. | Sturgisson ....  | 515              |

In a few cases where the detailed studies of the present report show a different identification, the latter is shown in parentheses.

Additional quarries, observed in the preparation of the present report, have been described under their proper geological horizons in the chapters on Stratigraphy.

### *Available Stone*

Reference to the quarries noted above will show that a wide use has already been made of various sandstones of this area. Since the presence of good sandstone for building purposes is general, the statement is warranted that the sandstone industry deserves a much greater development. The following table will show the various sandstone horizons that are available for quarrying. They have been described already under the chapters devoted to Stratigraphy and their points of maximum development given. Those given in black font type have already been quarried within this area:

#### **Dunkard Series:**

Proctor Sandstones.  
**St. Cloud Sandstone.**  
 Gilmore Sandstone.  
 Taylor Sandstone.  
 Nineveh Sandstone.  
 Burton Sandstone.  
**Fish Creek Sandstone.**  
**Rush Run Sandstone.**  
 Jollytown Sandstone.  
 Hundred Sandstone.  
 Upper Marietta Sandstone.  
 Lower Marietta Sandstone.  
 Mannington Sandstone.  
**Waynesburg Sandstone.**  
**Monongahela Series:**  
 Gilboy Sandstone.  
**Arnoldsburg Sandstone.**  
 Upper Sewickley Sandstone.  
 Lower Sewickley Sandstone.

#### **Upper Pittsburgh Sandstone.**

#### **Conemaugh Series:**

**Lower Pittsburgh Sandstone.**  
**Connellsville Sandstone.**  
**Lower Connellsville Sandstone.**  
**Morgantown Sandstone.**  
**Grafton Sandstone.**  
**Saltsburg Sandstone.**  
**Buffalo Sandstone.**  
**Mahoning Sandstone.**

#### **Allegheny Series:**

**Upper Freeport Sandstone.**  
**Lower Freeport Sandstone.**

#### **Pottsville Series:**

**Homewood Sandstone.**  
**Upper Connoquenessing Sandstone.**  
**Lower Connoquenessing Sandstone.**

Reference is here made to Chapter XXV of Vol. IV of the State Geological Survey Reports, by G. P. Grimsley, for an exhaustive discussion of the "Examination and Testing of Building Stone."

**IRON ORE.*****Old Furnaces***

Monongalia county was the scene of an extensive iron making industry from 1800 to 1870. Five furnaces were operated along Cheat river near Ice's Ferry, one at Clinton Furnace, on Booths creek, and one at Rock Forge on Deckers creek. In Marion county there was a furnace on Piney run of Pricketts creek, Winfield district. In Taylor county there was a furnace on the Tygart Valley river at the mouth of Lost run and another on Threefork creek at Irontown. With the exception of the Irontown furnace, on which no information is available, these old furnaces were all described by G. P. Grimsley in Chapter V of Vol. IV of the State Geological Survey Reports.

***Available Ore***

The available iron ores of the territory of this report are to be found in the Conemaugh, Allegheny and Pottsville series of rocks.

**Iron Ore of the Conemaugh Series.**

**Johnstown Iron Ore.**—At Lock No. 13 on the Monongahela river, one mile westward from Little Falls, a section published in Chapter VII shows a stratum of iron carbonate ore 6 inches thick and lying 20 feet under the Brush Creek coal. A sample collected here shows the following partial analysis, according to Messrs. Hite and Krak:

|                                   | Per cent. |
|-----------------------------------|-----------|
| Silica (Si O <sub>2</sub> ) ..... | 12.12     |
| Metallic Iron .....               | 38.78     |
| Lime (Ca O) .....                 | 4.53      |
| Sulphur .....                     | 1.07      |
| Phosphorus .....                  | 0.60      |

According to I. C. White the same iron ore is well exposed in a cut of the Buckhannon & Northern Railroad opposite Scrafford, near Morgantown. On Wickwire run in Fetterman

district, Taylor county, there is an exposure of iron ore at this horizon in the form of nuggets scattered through the Brush Creek shale. In many other locations where this horizon is exposed no iron ore was observed, so that its occurrence at this horizon is uncommon.

### Iron Ore of the Allegheny Series.

In eastern Monongalia county, eastern Marion and north-eastern Taylor there is a large amount of iron carbonate ore lying just beneath the Upper Freeport coal. In some places it evidently replaces the Upper Freeport limestone, as the two are intimately associated. Nodules of the ore are often found scattered through a gray shale for a distance of thirty feet below the coal. This ore is exposed in the old workings near Rock Forge, Monongalia county. On a branch of Booths creek one mile north of Clinton Furnace, Reger observed 25 feet of ferriferous shales just under the Upper Freeport coal. The same coal is mined in the hills at Clinton Furnace.

In Winfield district, Marion county, on Prickett creek, one-half mile south of Canton, Reger found 1 foot of iron ore fourteen feet below the Upper Freeport coal. A sample collected here gave the following partial analysis according to Messrs. Hite and Krak:

|                                   | Per cent. |
|-----------------------------------|-----------|
| Silica (Si O <sub>2</sub> ) ..... | 14.84     |
| Metallic Iron .....               | 38.99     |
| Lime (Ca O) .....                 | 4.81      |
| Sulphur .....                     | 1.31      |
| Phosphorus .....                  | 0.36      |

At the old Piney Furnace in Winfield district, Reger observed 51 feet of shales with nodules of limestone and iron carbonate beginning 20 feet under the Upper Freeport coal. At Irontown, Taylor county, he also found an old stripping of iron ore at this horizon just north of Threefork creek, but its thickness was concealed. At Irondale, Preston county, near the Taylor line, this ore was formerly mined extensively for furnace use. The stratum shows 2 feet 9 inches of calcareous iron carbonate lying just below the Upper Freeport limestone.

A sample collected here shows the following partial analysis according to Messrs. Hite and Krak:

|                                  | Per cent. |
|----------------------------------|-----------|
| Silica (Si O <sub>2</sub> )..... | 3.60      |
| Metallic Iron.....               | 32.88     |
| Lime (Ca O).....                 | 13.83     |
| Sulphur .....                    | 0.73      |
| Phosphorus .....                 | 1.99      |

This ore has been worked at other points along Threefork creek south of Irondale along the Taylor-Preston line, so that it is safe to assume that the hills of this portion of Taylor county contain a large amount of ore.

Below the Lower Kittanning coal the iron ore at the horizon of the Vanport limestone or Buhrstone iron ore was observed at a few localities. One-half mile east of Dellslow, according to Reger, float ore from this formation is exposed in the field near the M. & K. railroad and a short distance above the Homewood sandstone. On the head of Booths creek near the residence of Granville Brown it is exposed in the road where it is from 12 to 18 inches thick and lies 10 feet above the Homewood sandstone. At the Eureka school house at the mouth of Laurel run of Whiteday creek, Marion county, this ore is exposed. Here it has the following section:

|                                | Feet.         |
|--------------------------------|---------------|
| 1. Coal, Lower Kittanning..... |               |
| 2. Concealed .....             | 35            |
| 3. Iron ore.....0' 10"         |               |
| 4. Shale, buff.....3 0         | }..... 4' 10" |
| 5. Iron ore.....1 0            | }             |

A sample collected from Nos. 3 and 5 of section shows the following partial analysis, according to Messrs. Hite and Krak:

|                                  | Per cent. |
|----------------------------------|-----------|
| Silica (Si O <sub>2</sub> )..... | 18.40     |
| Metallic Iron.....               | 56.64     |
| Lime (Ca O).....                 | Trace.    |
| Sulphur .....                    | 1.35      |
| Phosphorus .....                 | 0.45      |

At all these points this ore has a deep red color, apparently being thoroughly oxidized. Another exposure of this ore was

observed by Reger at Irontown where it was formerly mined for furnace use. Here there is 44 feet of shale with boulders of limestone and iron carbonate ore lying just above the Clarion coal. A sample of ore collected here shows the following partial analysis according to Messrs. Hite and Krak:

|                                  | Per cent. |
|----------------------------------|-----------|
| Silica (Si O <sub>2</sub> )..... | 13.08     |
| Metallic Iron.....               | 37.33     |
| Lime (Ca O).....                 | 5.43      |
| Sulphur .....                    | 0.67      |
| Phosphorus .....                 | 0.96      |

### Iron Ores of the Pottsville Series.

Between the Homewood and Upper Connoquenessing sandstones iron ore is frequently found. There are sometimes two or three horizons of ore varying in composition from calcareous carbonates to rich hematites. These ores are prevalent in the neighborhood northeast of Ices Ferry in Monongalia county where they were extensively worked at the old furnaces. South of Cheat river at Cheat View, the following exposure of ore was observed at an old digging:

|  | Feet. |
|--|-------|
| 1. Sandstone, flaggy.....                            | 2     |
| 2. Concealed and coal blossom.....                   | 2     |
| 3. Fire clay and concealed.....                      | 9     |
| 4. Iron ore, thickness concealed.....                | 0     |
| 5. Concealed to Upper Connoquenessing sandstone..... | 10    |

A sample collected from the dump shows the following partial analysis according to Messrs. Hite and Krak:

|                                  | Per cent. |
|----------------------------------|-----------|
| Silica (Si O <sub>2</sub> )..... | 9.67      |
| Metallic Iron.....               | 45.73     |
| Lime (Ca O).....                 | 0.78      |
| Sulphur .....                    | 1.10      |
| Phosphorus .....                 | 0.37      |

At Powell, Marion county, on the Tygart Valley river, there is a ferriferous limestone, 6 inches thick, lying just above the Lower Mercer coal that probably represents one of the ore horizons of the Cheat river canyon. There is another exposure at Barkers Mill on Lost run, from which an analysis may be

found under the description of the Pottsville Series in Chapter IX.

Below the Upper Connoquenessing sandstone there is another group of iron ores that have been worked on Cheat river. There are several horizons contained in the sandy shales between the Upper Connoquenessing sandstone and the top of the Mauch Chunk series. These ores were observed at several points between Cheat river and the Pennsylvania State line.

An excellent treatise on the iron ores of the Cheat river region is given in the report made by Dr. Wm. B. Rogers<sup>2</sup> for the Pridevale Iron Company in 1854. Since the ore was being mined at the time of his report, it was possible for Dr. Rogers to obtain a much more satisfactory view of the strata than is to be had at the present time. In Vol. IV., Chapter V., of the State Geological Survey Reports, G. P. Grimsley has furnished a large amount of valuable data on the iron ores of the territory of this report. In Vol. IV. will be found extensive quotations from Dr. Rogers' report.

### WATER POWER RESOURCES.

It is only within the last three or four years that the great water power resources of West Virginia have attracted the attention they merit and inasmuch as the first great project for utilizing such power in the State is located within the boundaries of the territory of this report, a brief discussion of the same is of special interest to the residents therein.

The gradual exhaustion of our large stores of mineral fuels will hasten the development of our water power to the economic limit. The following interesting statements are taken from a Paper on the Water Power Resources of West Virginia<sup>3</sup> by A. H. Horton, District Engineer, Water Resources Branch U. S. Geological Survey.

“\*\*\*\*\*the minimum amount of energy developed by the streams in West Virginia is about 350,000 horsepower, the assumed maximum is 1,163,000 horsepower. It takes from 11-15 tons per year of high grade steam coal to produce one continuous horsepower in the most efficient steam engines in ordinary use. The amount of coal, based upon the lower of the above figures, necessary to produce the minimum horse-

2. Geology of the Virginias, 1884; pages 679-701.

3. Report of Semi-Centennial Commission of W. Va.; 1913.



power developed by West Virginia streams is therefore 3,850,000 tons per year, to produce the maximum, 12,800,000 tons per year.

"The annual cost of producing power by steam plants varies from about \$25.00 to \$150.00 per horsepower, depending upon the type of engine and boiler and the capacity of the plant. These figures include interest at 5 per cent., depreciation, repair, oil, waste, labor and fuel, using coal at \$2.00 per ton.

"Water power must, of course, compete with steam power, derived, in general, from coal. It will therefore remain undeveloped unless it can be disposed of at less cost, except to certain customers who will pay a higher price for the convenience of obtaining electrical power.

"It costs from about \$45.00 to \$200.00 per horsepower measured at the turbine shaft to construct water power plants ready to deliver electrical power. This electrical power can be sold for less in the immediate vicinity of the power plant than anywhere else as the cost of transmission is considerable and varies with the distance, voltage, and amount transmitted.

"To prevent a threatened water power monopoly and reduce rates for electricity, the Province of Ontario, Canada, created a Hydro-Electric Power Commission in 1906 with full power to control plants and to buy and sell power. This Commission is now operating 300 miles of 110,000 volt main transmission lines, and 180 miles of distributing lines buying current from the Ontario Power Company, a private corporation at Niagara Falls, at \$9.00 per horsepower per annum. The rates charged the municipalities to cover cost, vary from \$18.00 to \$29.50 per horsepower per annum, according to distance. The Commission is supplying at present 30 municipalities. The City of Toronto, located approximately 90 miles from the source of power, purchases 10,000 horsepower from the Commission at the rate of \$18.50 per horsepower per annum for 24-hour service, which is very much less than it would cost if produced by steam plants.

"What has been done in Ontario, Canada, can be done in West Virginia or any other State. At present there is very little hydro-electric power developed in this State and the passing of laws to regulate the price of electricity for use as power or for illumination ought not to be a difficult matter. The need of legislation or of a Commission to regulate the charges for electricity is shown by the fact that at Buffalo electricity costs \$25.00 per year per horsepower, while at Toronto, which is three times as far from Niagara Falls, the common source of power, the price is 26 per cent. less."

The three following tables by Mr. Horton, taken from the same Paper, give the horsepower available from storage on the Tygart-Monongahela and Cheat rivers:

Table No. 12. Indicated Horsepower Developed by the Tygart-Monongahela River.

| Section of River           |                           | Length Miles. | Mean Drain-<br>age Area.... | Minimum Dis-<br>charge ..... | Assumed Dis-<br>charge f o r<br>Maximum<br>Development. | Total Fall<br>..... | Minimum<br>Horsepower . | Assumed Maximum<br>Development<br>Horsepower. | Horsepower (b) Available<br>from Storage for |         |         |
|----------------------------|---------------------------|---------------|-----------------------------|------------------------------|---|---------------------|-------------------------|---|--|---------|---------|
| From                       | To                        |               |                             |                              |   |                     |                         |   | 12 mos.                                      | 6 mos.  | 3 mos.  |
| <b>Tygart River</b>        |                           |               |                             |                              |   |                     |                         |   |  |         |         |
| Source .....               | Below Pound Mill Run...   | 19            | a88                         | 7                            | 46  | 1800                | 290                     | 1900  | .....  | .....   | .....   |
| Below Pound Mill Run...    | 2 mi. above Roaring creek | 31            | 205                         | 16                           | 106   | 280                 | 412                     | 2700  | .....  | .....   | .....   |
| 2 mi. above Roaring creek. | Above Middle fork .....   | 16½           | 379                         | 30                           | 197   | 250                 | 690                     | 4530  | .....  | .....   | .....   |
| Below Middle fork.....     | Above Buckhannon river.   | 3½            | 596                         | 48                           | 310   | 155                 | 684                     | 4420  | .....  | .....   | .....   |
| Below Buckhannon river.    | Below Frog run.....       | 23            | 1080                        | 86                           | 520   | 320                 | 2530                    | 15,300  | .....  | .....   | .....   |
| Below Frog run.....        | Above West Fork river.... | 28            | 1320                        | 106                          | 630   | 135                 | 1310                    | 7820  | .....  | .....   | .....   |
| <b>Monongahela River</b>   |                           |               |                             |                              |   |                     |                         |   |  |         |         |
| Below West Fork river...   | Lower pool, Dam No. 9..   | 31            | 2500                        | 150                          | 940   | 73                  | 1000                    | 6300  | .....  | .....   | .....   |
| Totals .....               | .....                     | 152           | .....                       | .....                        | .....   | 3013                | 6916                    | 42,970  | 98,700                                       | 197,400 | 394,800 |

a= Total area; b = Continuous horsepower if all utilized in each period.

Table No. 15. Indicated Horsepower Developed by the Minor Tributaries of the Monongahela River.

| Stream.               | Section.                  |                           | Length, Miles. | Mean Drainage Area..... | Minimum Discharge ..... | Assumed discharge for maximum development | Total Fall..... | Minimum Horsepower . | Assumed Maximum Development Horsepower . |
|-----------------------|---------------------------|---------------------------|----------------|-------------------------|-------------------------|---|-----------------|----------------------|--|
|                       | From                      | To                        |                |                         |                         |   |                 |                      |  |
| Middle fork.....      | Source                    | Below Cassidy fork.....   | 15             | a 65                    | 5                       | 34  | 1,200           | 138                  | 940                                      |
| Middle fork.....      | Below Cassidy fork.....   | Mouth .....               | 25             | 113                     | 9                       | 59  | 540             | 447                  | 2,930                                    |
| Buckhannon river..... | Source                    | Alexander .....           | 17             | a 90                    | 7                       | 47  | 1,300           | 209                  | 1,410                                    |
| Buckhannon river..... | Alexander .....           | ¼ mi. above Sand run..... | 33             | 200                     | 16                      | 104                                       | 470             | 692                  | 4,490                                    |
| Buckhannon river..... | ¼ mi. above Sand run..... | Mouth .....               | 11             | 330                     | 26                      | 171                                       | 60              | 144                  | 944                                      |
| Sandy creek.....      | Source                    | Mouth .....               | 20             | a 84                    | 7                       | 44  | 1,000           | 161                  | 1,010                                    |
| Three Fork creek..... | Source                    | Mouth .....               | 25             | a 98                    | 8                       | 51  | 1,000           | 184                  | 1,170                                    |
| West Fork river.....  | Source                    | Below Washburn run.....   | 22             | a 105                   | 4                       | 19  | 500             | 46                   | 218                                      |
| West Fork river.....  | Below Washburn run.....   | Tygart river.....         | 70             | 475                     | 17                      | 88  | 160             | 250                  | 1,300                                    |
| Buffalo creek.....    | Source                    | Monongahela river.....    | 55             | a 130                   | 4                       | 24  | 400             | 37                   | 221                                      |
| Deckers creek.....    | Source                    | Monongahela river.....    | 25             | a 57                    | 2                       | 10  | 790             | 36                   | 182                                      |
| Dunkard creek.....    | Source                    | Monongahela river.....    | 35             | a 200                   | 7                       | 37  | 400             | 64                   | 340                                      |
| Totals .....          |                           |                           |                |                         |                         |   |                 | 2,408                | 15,165                                   |

a=Total area.

Table No. 13. Indicated Horsepower Developed by Cheat River.

| Section of River.      |                        | Length, Miles. | Mean Drainage Area..... |          | Minimum Discharge..... | Assumed discharge for Maximum Development | Total Fall..... | Minimum Horsepower | Assumed Maximum Development | Horsepower | Horsepower (b) Available From Storage For |                |
|------------------------|------------------------|----------------|-------------------------|----------|------------------------|---|-----------------|--------------------|-----------------------------|------------|---|----------------|
| From                   | To                     |                | Sq. mi.                 | Sec.-ft. |                        |   |                 |                    |                             |            | Sec.-ft.                                  | 12 mos. 6 mos. |
| Source .....           | 3060-ft. contour ..... | 30             | a 88                    | 24       | 59                     | b1500                                     | 826             | 2,030              | .....                       | .....      | .....                                     | .....          |
| 3000-ft. contour ..... | Above Dry fork .....   | 45             | 151                     | 41       | 101                    | 1370                                      | 5,160           | 12,700             | .....                       | .....      | .....                                     | .....          |
| Below Dry fork .....   | Albright .....         | 45             | 865                     | 151      | 545                    | 440                                       | 6,120           | 22,100             | .....                       | .....      | 21,100                                    | 84,400         |
| Albright .....         | Mouth .....            | 29             | 1220                    | 214      | 770                    | 400                                       | 7,880           | 28,300             | .....                       | .....      | 27,200                                    | 108,800        |
| Totals .....           | .....                  | 149            | .....                   | .....    | .....                  | 3710                                      | 19,986          | 66,130             | .....                       | .....      | 48,300                                    | 96,600         |

a=Total area; b=Fall reduced to 280 feet by proposed Cheat river reservoir.

### *Present Development.*

**Hydro-Electric Company of West Virginia.**—As mentioned in Chapter II., the Hydro-Electric Company of West Virginia, formerly known as the West Virginia Development Company, has already begun the construction of a great dam about 80 feet high on Cheat river within the territory of this report, located about 500 feet southeast of the Pennsylvania-West Virginia State line, and a similar dam is projected by the same company on this river near Beaver Hole at the Monongalia-Preston county line. The air line distance of Morgantown from the Cheat Haven dam is 8 miles, and to the Beaver Hole dam, 9 miles. An account of the first mentioned dam as given on page 37 of the Industrial Supplement of the Post-Chronicle, Morgantown, W. Va., under date January 16, 1913, and subsequently revised by F. W. Scheidenhelm, Chief Engineer of the Hydro-Electric Company, is as follows:

“The power plant is located on Cheat river near Cheat Haven, Pa., just up-stream from the Pennsylvania-West Virginia state line. The dam and power house are being built of concrete, the dam to have a height of 80 feet and a length of about 1000 feet. As a protection against floods the upper 20 feet of the dam will consist of a series of 26 huge gates 17 feet high, which in times of emergency can be opened wide permitting a discharge of more than 150,000 cubic feet per second. Such an amount of water would be far in excess of the worst Cheat river flood on record, that of the year 1888. Ordinarily only as many gates will be opened as are necessary to pass the excess water which cannot be utilized for power, the manipulation of the gates being for the purpose of keeping the level of the water in the large reservoir above the dam at practically the same elevation at all times. The effect of this regulation on the river flow and the constant use of water for power production will materially supplement the extreme low water in both the Cheat river and Monongahela river, resulting in the maintenance of the coal stage in the latter throughout the year, and in prolonging the coal stage in the Ohio river for a considerable length of time. On the other hand during periods of extreme high water the reservoir will tend to ameliorate flood conditions at Point Marion.

“The power house, a building about 234 feet in length and 100 feet in width, is being erected as a portion of the dam structure near the right bank of the river. The plant will consist of an equipment of four water turbines capable of developing 12,000 H. P. each thus placing the total installed capacity of the plant at 48,000 H. P. Each of the powerful hydro-electric units will weigh in the neighborhood of 250 tons.

“In order to be able to guarantee to its customers steady and reliable power even during seasons of drought, the Hydro-Electric Company is arranging with the West Penn Traction Company to connect its transmission lines with those of that Company. Thus when the water supply is inadequate to generate sufficient power to meet

demands, the deficiency can be made up by drawing upon the output of the steam plant of the Traction Company, located on the Youghiogheny river one mile above Conne!sville, Pa.

"One feature of this large hydro-electric development which will add materially to the attractions of the already picturesque Cheat River Valley, is the magnificent body of water that will be backed up by the dam. The artificial lake, thirteen miles in length, will be the largest body of water in the region, and certainly the most attractive, within easy reach of Pittsburgh. The possibilities that this offers in the way of boating and fishing will surely be appreciated by the constantly growing number of summer visitors to this beautiful resort."

## FORESTS.

In Vol. V., Chapter VI., of the State Geological Survey Reports, published in 1911, A. B. Brooks, State Forester, gives a detailed description of the forests of the State by counties. As that publication is available, only such portions as relate to present forest conditions will be republished here.

### Present Forest Conditions—Monongalia County.

"Areas of virgin forest aggregating about 7,600 acres still remain on the waters of Cheat river and Deckers creek in the eastern end of the county. The principal tract, containing approximately 5,000 acres, lies on the east of Cheat river and adjoins the forests of Preston county. Several hundred acres of virgin forest which is not heavily timbered lies on the steep faces of the Cheat river mountains, and areas of less extent lie on the hills on both sides of Deckers creek. The cut-over forests, containing about 11,000 acres, also lie in the same region.

"The remainder of the county is divided up into farms which are partly cleared and partly wooded. As a rule, the farmers' woodlots have but little timber."

### Present Forest Conditions—Marion County.

"From 80 to 90 per cent of the county is cleared land. The woodland contains only a little good timber and is owned by farmers who hold it for domestic purposes in connection with their farms. In parts of Mannington and Lincoln districts, especially, there are woodlots of considerable size which contain valuable stands of hardwoods."

### Present Forest Conditions—Taylor County.

"Farmers own all the land of the county, and the forest land remaining is in scattered woodlots. In some sections at least 75 per cent of the land is cleared. This is true in the best agricultural areas adjoining Harrison and Barbour counties. In other sections the percentage of cleared land is much smaller, and here the farmers have reserved considerable good timber. Many woodlots, it is said, have 5,000 feet per acre of sound oak, hickory, and other timber, still standing on them."

# CHAPTER XIV.

## SOIL SURVEY OF THE MORGANTOWN AREA

(Monongalia, Marion and Taylor Counties.)

By Charles N. Mooney and W. J. Latimer.

### CLIMATE.

The following tables, giving meteorological data for the area, were secured from Mr. H. C. Howe, Section Director, United States Weather Bureau, Parkersburg, W. Va., and as they are more complete than those given by Messrs. Mooney and Latimer, they replace the tables given on page 8 of their report on the Soil Survey of these counties which is herein quoted in full from page 9:

#### Monthly and Annual Mean Temperatures at Morgantown.

(Horace Atwood, Observer).

| Year     | Jan. | Feb. | Mar. | April | May  | June | July | Aug. | Sept. | Oct. | Nov. | Dec. | Average |
|----------|------|------|------|-------|------|------|------|------|-------|------|------|------|---------|
| 1892.... | 28.4 | 37.0 | 36.2 | 47.7  | ...  | ...  | 76.6 | 73.4 | 65.4  | 51.6 | 41.8 | 30.8 | ...     |
| 1893.... | 22.8 | 36.0 | 41.6 | 52.8  | ...  | 71.6 | 74.5 | 72.8 | ...   | 55.3 | 40.3 | 34.6 | ...     |
| 1894.... | 34.8 | 32.6 | 44.8 | ...   | 64.2 | 65.6 | 73.4 | 71.6 | 70.4  | 53.5 | 43.9 | 36.7 | ...     |
| 1895.... | 29.5 | 22.1 | 38.2 | 52.4  | ...  | ...  | 70.0 | 73.0 | 69.7  | 46.2 | 43.8 | 35.8 | ...     |
| 1896.... | 31.0 | 32.4 | 33.4 | 56.6  | 68.2 | 70.0 | 73.6 | ...  | 65.9  | 51.6 | 45.5 | 35.0 | ...     |
| 1897.... | 29.6 | 36.5 | 46.0 | 51.5  | 56.4 | 67.8 | 75.2 | 70.1 | 67.8  | 59.4 | 44.9 | 38.1 | 53.6    |
| 1898.... | 37.6 | 33.4 | 47.8 | 46.8  | 62.6 | 71.4 | 75.2 | 75.1 | 71.2  | 56.5 | 42.2 | ...  | ...     |
| 1899.... | 30.6 | 26.0 | 41.6 | 53.8  | 64.4 | 71.4 | 74.3 | 74.5 | 65.2  | ...  | 46.1 | ...  | ...     |
| 1900.... | 35.6 | 31.0 | 37.8 | 50.7  | 63.2 | 72.0 | 75.4 | 76.9 | 72.2  | 61.0 | 45.4 | 34.2 | 54.6    |
| 1901.... | 33.2 | 24.6 | 42.5 | 46.5  | 61.6 | 70.8 | 77.6 | 72.8 | 66.9  | 55.4 | 36.5 | 32.6 | 51.8    |
| 1902.... | 29.4 | 25.1 | 44.3 | 49.4  | 64.2 | 67.8 | 73.6 | 69.0 | 65.4  | 57.2 | 52.2 | 33.2 | 52.6    |
| 1903.... | 31.7 | 33.8 | 50.8 | 52.2  | 65.0 | 64.6 | 72.2 | 71.4 | 66.7  | 56.4 | 38.6 | 27.2 | 52.6    |
| 1904.... | 27.2 | 28.4 | 43.2 | 47.6  | 63.0 | 69.5 | 71.0 | 70.2 | 67.6  | 55.6 | 41.7 | 31.6 | 51.4    |
| 1905.... | 25.6 | 24.8 | 46.4 | 51.0  | 62.5 | 69.7 | 73.3 | 71.2 | 66.6  | 55.6 | 41.6 | 36.0 | 52.0    |
| 1906.... | 39.4 | 31.6 | 36.7 | 53.6  | 62.9 | 70.3 | 72.1 | 74.6 | 69.8  | 54.8 | 44.2 | 35.4 | 53.8    |
| 1907.... | 36.6 | 29.4 | 48.4 | 44.0  | 57.6 | 64.5 | 71.2 | 69.0 | 66.0  | 49.7 | 41.6 | 35.2 | 51.1    |
| 1908.... | 31.6 | 30.1 | 47.0 | 53.2  | 62.0 | 68.2 | 73.6 | 71.0 | 68.8  | 55.4 | 44.1 | 35.6 | 53.4    |
| 1909.... | 37.4 | 40.0 | 39.7 | 52.4  | 60.6 | 70.8 | 70.5 | 71.7 | 65.2  | 51.2 | 50.5 | 28.0 | 53.2    |
| 1910.... | 32.2 | 31.8 | 51.2 | 53.9  | 57.8 | 65.6 | 73.8 | 71.6 | 68.2  | 59.6 | 37.4 | 28.4 | 52.6    |
| 1911.... | 37.4 | 38.4 | 39.8 | 49.6  | 68.2 | 70.6 | 74.0 | 73.7 | 69.5  | 55.6 | 40.5 | 40.4 | 54.8    |
| 1912.... | 23.6 | 27.7 | 38.8 | 55.3  | 64.6 | 67.4 | 74.1 | 68.8 | 69.6  | 56.2 | 45.0 | 38.4 | 52.5    |
| Means.   | 31.7 | 31.1 | 42.7 | 51.0  | 62.7 | 68.9 | 73.6 | 72.1 | 67.9  | 54.9 | 43.2 | 34.1 | 52.8    |

## Monthly and Annual Precipitation at Morgantown.

(Horace Atwood, Observer).

| Year    | Jan.  | Feb.  | Mar.  | Apr.  | May   | Jun.  | July  | Aug.  | Sept. | Oct.  | Nov.  | Dec.  | Totals |
|---------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| 1873... | 3.34  | 5.31  | 4.01  | 2.18  | 4.11  | 5.68  | 7.61  | 4.71  | 3.52  | 5.76  | 3.54  | 2.99  | 52.76  |
| 1874... | 3.17  | 2.29  | 3.45  | 7.20  | 1.25  | 4.55  | 5.75  | 2.16  | 5.05  | 0.24  | 4.72  | 5.30  | 45.11  |
| 1875... | 3.12  | 2.74  | 5.41  | 2.90  | 1.69  | 4.09  | 7.89  | 5.58  | 5.10  | 3.57  | 4.18  | 3.99  | 50.26  |
| 1876... | 4.25  | 3.85  | 4.97  | 2.80  | 3.26  | 3.00  | 9.35  | 3.77  | 7.16  | 1.63  | 2.17  | 1.95  | 48.16  |
| 1877... | 4.26  | 1.09  | 3.98  | 2.51  | 2.25  | 6.70  | 5.80  | 4.65  | 2.54  | 3.53  | 4.52  | 1.62  | 43.45  |
| 1878... | 3.95  | 1.20  | 3.82  | 2.80  | 2.87  | 4.35  | 3.74  | 2.50  | 3.24  | 3.87  | 5.95  | 4.84  | 43.13  |
| 1879... | 3.41  | 2.38  | 4.56  | 1.47  | 1.35  | 4.64  | 7.10  | 6.62  | 1.27  | 1.62  | 2.24  | 6.70  | 43.36  |
| 1880... | 5.77  | 4.53  | 5.10  | 4.30  | 2.24  | 6.66  | 3.80  | 7.25  | 3.18  | 3.07  | 1.99  | 3.99  | 51.83  |
| 1881... | 3.07  | 3.56  | 2.12  | 2.30  | 3.28  | 4.77  | 5.61  | 0.41  | 2.78  | 4.55  | 3.19  | 5.93  | 41.58  |
| 1882... | 6.78  | 5.41  | 7.18  | 3.36  | 4.51  | 3.39  | 3.64  | 7.72  | 7.23  | 1.86  | 2.28  | 1.92  | 55.23  |
| 1883... | 4.93  | 7.07  | 4.01  | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | .....  |
| 1884... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | .....  |
| 1885... | 4.75  | 2.62  | 1.60  | 3.31  | ..... | 6.18  | 2.78  | 7.43  | 1.45  | 5.07  | 2.75  | 2.39  | .....  |
| 1886... | 4.01  | 2.26  | 3.15  | 4.50  | 6.46  | 7.00  | 4.29  | 5.55  | 3.51  | 1.51  | 4.02  | ..... | .....  |
| 1887... | 1.33  | 6.28  | 1.32  | 3.35  | 1.16  | 3.08  | 2.96  | 4.32  | 3.19  | 0.81  | 1.37  | 1.55  | 30.72  |
| 1888... | 6.85  | 2.34  | 3.77  | 2.39  | 5.82  | 3.73  | 7.29  | 8.70  | 5.03  | 7.14  | 4.90  | 1.92  | 59.88  |
| 1889... | 2.75  | 2.68  | 3.09  | 4.97  | 6.37  | 4.47  | 5.12  | 1.61  | 3.91  | 3.34  | 7.87  | 2.85  | 49.03  |
| 1890... | 5.83  | 5.87  | 5.84  | 4.13  | 8.10  | 6.83  | 3.41  | 7.08  | 7.71  | 8.20  | 2.67  | 3.87  | 69.54  |
| 1891... | 3.93  | 6.31  | 4.15  | 2.72  | 3.20  | 6.08  | 7.52  | 7.45  | 3.20  | 6.59  | 3.68  | 3.82  | 54.65  |
| 1892... | 3.64  | 2.05  | 4.68  | 3.02  | 5.28  | 3.15  | 6.97  | 1.81  | 1.42  | 1.30  | 2.89  | 2.38  | 38.59  |
| 1893... | 2.97  | 5.05  | 1.02  | 5.46  | 3.38  | 1.94  | 1.66  | 1.34  | 2.20  | 2.89  | 2.38  | 2.14  | 32.43  |
| 1894... | 2.45  | 3.56  | 1.57  | 2.95  | 1.03  | 1.70  | 3.07  | 1.77  | 2.52  | 3.14  | 3.47  | 3.83  | 31.06  |
| 1895... | 4.74  | 1.45  | 1.77  | 2.48  | 1.39  | 5.55  | 2.82  | 2.18  | 1.25  | 1.02  | 1.65  | 1.85  | 28.15  |
| 1896... | 0.96  | 3.74  | 3.35  | 1.68  | 3.57  | 4.16  | 9.80  | 1.91  | 3.78  | 3.08  | 4.17  | 1.36  | 41.56  |
| 1897... | 2.35  | 3.94  | 3.88  | 3.80  | 4.91  | 5.77  | 5.55  | 3.04  | 1.23  | 0.29  | 5.24  | 2.77  | 42.77  |
| 1898... | 5.78  | 1.68  | 6.20  | 4.86  | 4.78  | 5.17  | 4.01  | 7.91  | 2.79  | 5.56  | 2.67  | 0.71  | 52.12  |
| 1899... | 4.37  | 5.67  | 6.63  | 1.94  | 4.72  | 6.43  | 3.38  | 1.78  | 2.26  | 0.50  | 0.35  | 3.50  | 42.53  |
| 1900... | 1.59  | 2.96  | 3.59  | 1.51  | 2.14  | 5.39  | 6.93  | 4.33  | 0.48  | 3.91  | 5.06  | 1.54  | 39.43  |
| 1901... | 1.96  | 0.55  | 3.67  | 6.15  | 6.10  | 2.34  | 1.86  | 7.37  | 3.68  | 0.36  | 3.02  | 5.57  | 42.63  |
| 1902... | 3.63  | 2.48  | 3.92  | 3.48  | 1.72  | 7.16  | 8.42  | 4.87  | 3.24  | 3.95  | 2.24  | 6.12  | 51.23  |
| 1903... | 2.87  | 6.47  | 4.28  | 3.55  | 4.12  | 5.21  | 5.46  | 1.34  | 1.21  | 3.21  | 2.26  | 1.70  | 41.68  |
| 1904... | 2.70  | 2.02  | 4.32  | 2.86  | 2.91  | 5.55  | 4.50  | 2.18  | 1.38  | 1.74  | 0.15  | 2.56  | 32.87  |
| 1905... | 3.48  | 1.75  | 5.13  | 3.38  | 3.63  | 3.94  | 5.36  | 4.16  | 1.96  | 4.98  | 2.48  | 3.85  | 44.19  |
| 1906... | 3.92  | 1.58  | 3.73  | 4.10  | 3.14  | 4.52  | 3.57  | 2.93  | 2.85  | 3.14  | 1.62  | 5.48  | 40.58  |
| 1907... | 7.51  | 2.24  | 6.97  | 2.79  | 4.06  | 4.33  | 9.36  | 2.62  | 4.97  | 3.44  | 3.05  | 3.04  | 54.38  |
| 1908... | 2.23  | 3.19  | 6.04  | 3.28  | 6.04  | 2.74  | 3.55  | 1.29  | 0.70  | 0.53  | 0.82  | 2.26  | 32.67  |
| 1909... | 4.07  | 3.85  | 2.48  | 5.20  | 2.80  | 5.18  | 3.11  | 2.52  | 1.32  | 2.55  | 0.83  | 2.00  | 35.91  |
| 1910... | 6.70  | 2.63  | 0.36  | 2.06  | 3.69  | 4.89  | 4.08  | 2.32  | 3.34  | 1.77  | 2.24  | 2.13  | 36.21  |
| 1911... | 6.87  | 1.37  | 2.54  | 4.87  | 1.79  | 4.98  | 4.23  | 10.11 | 5.73  | 5.65  | 1.98  | 4.03  | 54.15  |
| 1912... | 2.43  | 2.60  | 6.59  | 3.37  | 2.79  | 3.42  | 11.17 | 2.44  | 3.26  | 1.10  | 1.28  | 1.95  | 42.40  |
| Means.  | 3.92  | 3.30  | 3.95  | 3.42  | 3.57  | 4.70  | 5.33  | 4.15  | 3.17  | 2.96  | 2.94  | 3.15  | 44.56  |



### Snowfall at Morgantown. (Horace Atwood, Observer).

| Year       | Jan.  | Feb.  | Mar.  | Apr.  | May   | Jun.  | July  | Aug.  | Sept. | Oct.  | Nov.  | Dec.  |
|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1893.....  | 19.3  | 2.0   | 3.5   | 0.    | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 1894.....  | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 0.5   | 17.0  |
| 1895.....  | 8.8   | 14.5  | 0.6   | 0.    | ..... | ..... | ..... | ..... | ..... | ..... | 0.    | 1.3   |
| 1896.....  | 0.8   | 2.8   | 21.8  | 0.2   | ..... | ..... | ..... | ..... | ..... | ..... | 0.    | 4.8   |
| 1897.....  | 1.4   | 0.1   | T     | 0.    | ..... | ..... | ..... | ..... | ..... | ..... | T     | 2.5   |
| 1898.....  | 3.2   | 2.0   | T     | 3.4   | ..... | ..... | ..... | ..... | ..... | ..... | 2.0   | 3.2   |
| 1899.....  | 9.3   | 12.8  | 3.8   | T     | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 1900.....  | 0.2   | 5.0   | 10.8  | 0.    | ..... | ..... | ..... | ..... | ..... | ..... | 0.2   | T     |
| 1901.....  | 6.5   | 3.0   | 1.0   | 6.0   | ..... | ..... | ..... | ..... | ..... | ..... | 3.5   | 2.0   |
| 1902.....  | 12.0  | 6.0   | 20.0  | 18.0  | ..... | ..... | ..... | ..... | ..... | ..... | T     | 17.0  |
| 1903.....  | 8.0   | 7.6   | T     | T     | ..... | ..... | ..... | ..... | ..... | ..... | 3.0   | 13.0  |
| 1904.....  | 14.0  | 4.0   | 1.5   | 1.0   | ..... | ..... | ..... | ..... | ..... | T     | T     | 9.0   |
| 1905.....  | 25.5  | ..... | ..... | 2.0   | ..... | ..... | ..... | ..... | ..... | ..... | T     | 1.0   |
| 1906.....  | 6.0   | 7.0   | 10.0  | T     | T     | ..... | ..... | ..... | ..... | T     | 10.   | 11.5  |
| 1907.....  | 8.0   | 9.0   | 5.0   | 3.0   | ..... | ..... | ..... | ..... | ..... | .0    | T     | 6.0   |
| 1908.....  | 10.0  | 3.0   | 3.0   | T     | T     | ..... | ..... | ..... | ..... | .0    | 4.0   | 2.0   |
| 1909.....  | 8.0   | T     | 4.5   | 1.0   | T     | ..... | ..... | ..... | ..... | T     | T     | 6.0   |
| 1910.....  | 14.0  | 9.0   | T     | T     | .0    | ..... | ..... | ..... | ..... | T     | 7.0   | 17.0  |
| 1911.....  | 7.0   | T     | 7.0   | 4.5   | .0    | ..... | ..... | ..... | ..... | .0    | T     | 3.0   |
| 1912.....  | 15.5  | 7.5   | 7.0   | T     | .0    | ..... | ..... | ..... | ..... | .0    | 0.5   | 6.0   |
| Means..... | 9.3   | 6.3   | 6.5   | 2.1   | T     | ..... | ..... | ..... | ..... | T     | 1.2   | 6.8   |

### Monthly and Annual Mean Temperature at Fairmont.

| Year    | Jan.  | Feb.  | Mar.  | Apr.  | May  | Jun. | July | Aug. | Sept. | Oct. | Nov.  | Dec. | Average |
|---------|-------|-------|-------|-------|------|------|------|------|-------|------|-------|------|---------|
| 1905... | ..... | ..... | 47.1  | 52.8  | 63.5 | 70.4 | 74.2 | 70.2 | 65.2  | 53.2 | 41.0  | 35.4 | .....   |
| 1906... | 40.2  | 32.1  | 37.8  | 53.1  | 62.5 | 71.9 | 72.7 | 75.6 | 68.4  | 54.5 | 44.4  | 35.8 | 54.1    |
| 1907... | 37.2  | 30.8  | 50.0  | 45.8  | 59.1 | 65.3 | 73.5 | 70.2 | 66.2  | 49.2 | 42.5  | 36.9 | 52.2    |
| 1908... | 32.2  | 32.0  | 48.0  | 55.1  | 63.0 | 70.5 | 75.1 | 71.6 | 66.6  | 55.4 | 42.1  | 35.6 | 53.9    |
| 1909... | 37.0  | 40.0  | 40.8  | 52.6  | 61.0 | 72.3 | 71.4 | 72.4 | 65.3  | 49.9 | 48.2  | 28.4 | 53.3    |
| 1910... | 31.7  | 34.8  | ..... | ..... | 58.1 | 68.0 | 75.8 | 73.7 | 69.8  | 59.5 | 38.0  | 28.1 | .....   |
| 1911... | 37.7  | 38.9  | 41.5  | 50.9  | 67.7 | 73.5 | 76.4 | 76.2 | 71.3  | 58.0 | ..... | 38.8 | .....   |
| 1912... | 21.4  | 26.4  | 38.9  | 55.1  | 64.4 | 69.0 | 76.2 | 70.8 | 70.8  | 55.7 | 42.4  | 34.2 | 52.1    |
| Means.  | 33.9  | 33.6  | 43.4  | 52.2  | 62.4 | 70.1 | 74.4 | 72.6 | 68.0  | 54.4 | 42.7  | 34.2 | 53.5    |

### Monthly and Annual Precipitation at Fairmont.

| Year    | Jan. | Feb. | Mar. | Apr. | May  | Jun. | July | Aug. | Sept. | Oct. | Nov. | Dec. | Totals |
|---------|------|------|------|------|------|------|------|------|-------|------|------|------|--------|
| 1892... | 4.00 | 2.31 | 2.78 | 3.56 | 4.90 | 3.62 | 4.39 | 2.79 | 2.31  | 1.02 | 3.56 | 2.20 | 37.44  |
| 1893... | 2.76 | 5.25 | 1.05 | 6.21 | 3.64 | 3.97 | 2.42 | 2.79 | 2.20  | 3.34 | 2.48 | 1.82 | 37.93  |
| 1894... | 2.03 | 3.53 | 1.81 | 3.51 | 3.45 | 4.23 | 2.96 | 1.57 | 2.19  | 2.40 | 2.38 | 4.59 | 34.65  |
| 1895... | 5.81 | 1.08 | 4.15 | 2.76 | 1.58 | 4.08 | 2.69 | 3.28 | 1.10  | 0.84 | 2.92 | 2.33 | 32.62  |
| 1896... | 1.16 | 2.79 | 4.48 | 1.57 | 5.92 | 4.59 | 13.3 | 2.64 | 4.41  | 2.95 | 3.13 | 2.29 | 49.26  |
| 1897... | 1.94 | 5.47 | 3.32 | 3.42 | 4.46 | 3.83 | 3.38 | 2.60 | 0.62  | 0.12 | 6.35 | 4.63 | 40.14  |
| 1898... | 4.99 | 2.10 | 6.10 | 4.40 | 4.71 | 3.36 | 3.10 | 7.40 | 2.47  | 5.81 | 2.66 | 2.77 | 49.80  |
| 1899... | 4.44 | 3.34 | 5.67 | 2.27 | 5.57 | 5.59 | 5.81 | 3.01 | 3.68  | 0.43 | 3.18 | 2.87 | 45.86  |

| Year    | Jan. | Feb. | Mar. | Apr. | May  | June | July | Aug. | Sept. | Oct. | Nov. | Dec. | Totals |
|---------|------|------|------|------|------|------|------|------|-------|------|------|------|--------|
| 1900... | 2.49 | 3.42 | 4.14 | 1.38 | 2.99 | 5.47 | 5.08 | 3.45 | 0.43  | 4.33 | 5.59 | 2.34 | 41.11  |
| 1901... | 2.52 | 0.67 | 3.54 | 6.68 | 6.24 | 5.46 | 1.91 | 2.92 | 4.29  | 0.38 | 3.23 | 6.02 | 43.86  |
| 1902... | 3.20 | 2.54 | 4.18 | 4.16 | 2.26 | 4.30 | 5.97 | 2.09 | 4.34  | 3.81 | 3.16 | 6.74 | 46.75  |
| 1903... | 2.76 | 4.94 | 5.40 | 3.46 | 2.62 | 5.88 | 6.58 | 1.74 | 1.34  | 2.87 | 2.70 | 1.80 | 42.09  |
| 1904... | 2.56 | 1.90 | 4.91 | 3.14 | 3.10 | 6.11 | 2.89 | 2.51 | 1.69  | 1.78 | 0.44 | 2.98 | 34.01  |
| 1905... | 3.58 | 1.76 | 6.26 | 2.80 | 4.44 | 4.10 | 8.70 | 5.19 | 2.81  | 6.16 | 2.63 | 3.90 | 52.28  |
| 1906... | 4.24 | 1.62 | 4.92 | 4.92 | 1.59 | 5.74 | 3.80 | 4.26 | 1.98  | 2.03 | 1.87 | 5.38 | 42.35  |
| 1907... | 7.70 | 3.53 | 5.89 | 2.71 | 5.84 | 4.64 | 6.83 | 6.15 | 3.80  | 2.59 | 3.89 | 3.11 | 56.68  |
| 1908... | 2.30 | 3.90 | 6.61 | 3.28 | 5.95 | 4.04 | 3.93 | 2.15 | 0.97  | 1.25 | 0.79 | 2.67 | 37.84  |
| 1909... | 3.73 | 5.63 | 3.43 | 6.11 | 4.51 | 7.45 | 3.30 | 2.18 | 2.10  | 2.26 | 0.72 | 2.43 | 43.85  |
| 1910... | 8.01 | 2.72 | 0.35 | 2.17 | 3.92 | 4.14 | 5.53 | 2.83 | 4.71  | 1.55 | 1.90 | 2.90 | 40.72  |
| 1911... | 6.25 | 1.91 | 2.52 | 4.28 | 1.28 | 4.89 | 3.50 | 8.14 | 4.37  | 5.03 | 1.89 | 2.15 | 46.21  |
| 1912... | 1.73 | 1.72 | 6.17 | 4.04 | 3.54 | 3.79 | 5.89 | 2.02 | 4.41  | 0.97 | 1.20 | 2.39 | 37.87  |
| Means.  | 3.72 | 2.96 | 4.18 | 3.66 | 3.93 | 4.73 | 4.86 | 3.41 | 2.68  | 2.47 | 2.70 | 3.25 | 42.55  |

Snowfall at Fairmont.

| Year       | Jan. | Feb. | Mar. | Apr. | May | Jun. | July | Aug. | Sept. | Oct. | Nov. | Dec. |
|------------|------|------|------|------|-----|------|------|------|-------|------|------|------|
| 1899.....  | ...  | ...  | ...  | ...  | ... | ...  | ...  | ...  | ...   | ...  | T    | 3.0  |
| 1900.....  | 2.5  | 6.2  | 9.5  | T    | ... | ...  | ...  | ...  | ...   | ...  | 3.0  | T    |
| 1901.....  | 9.0  | 4.2  | 3.8  | 11.0 | ... | ...  | ...  | ...  | ...   | ...  | 2.5  | 2.5  |
| 1902.....  | 10.5 | 7.8  | 16.5 | 15.0 | ... | ...  | ...  | ...  | ...   | ...  | T    | 15.4 |
| 1903.....  | 6.0  | 8.9  | T    | 0.   | ... | ...  | ...  | ...  | ...   | ...  | 1.0  | 4.4  |
| 1904.....  | ...  | 3.1  | 0.5  | 0.5  | ... | ...  | ...  | ...  | ...   | ...  | T    | 9.5  |
| 1905.....  | 22.5 | 2.4  | 0.8  | T    | ... | ...  | ...  | ...  | ...   | ...  | T    | 2.0  |
| 1906.....  | 3.0  | 6.5  | 18.3 | 0.   | ... | ...  | ...  | ...  | ...   | ...  | T    | 2.0  |
| 1907.....  | 3.5  | 8.0  | 10.0 | T    | ... | ...  | ...  | ...  | ...   | ...  | 1.0  | 5.5  |
| 1908.....  | 16.8 | 9.0  | T    | 0.5  | ... | ...  | ...  | ...  | ...   | ...  | 4.0  | 2.5  |
| 1909.....  | 4.5  | 0.4  | 1.0  | 1.0  | ... | ...  | ...  | ...  | ...   | ...  | T    | 6.4  |
| 1910.....  | 12.0 | 11.5 | T    | 0.   | ... | ...  | ...  | ...  | ...   | T    | T    | 14.0 |
| 1911.....  | 4.0  | 5.6  | 4.0  | 2.0  | ... | ...  | ...  | ...  | ...   | ...  | T    | 0.5  |
| 1912.....  | 10.2 | 5.9  | 3.3  | T    | ... | ...  | ...  | ...  | ...   | ...  | 0.4  | 7.0  |
| Means..... | 8.7  | 6.1  | 5.2  | 2.3  | ... | ...  | ...  | ...  | ...   | T    | 0.8  | 5.3  |

Monthly and Annual Mean Temperatures at Mannington.

| Year    | Jan. | Feb. | Mar. | Apr. | May  | Jun. | July | Aug. | Sept. | Oct. | Nov. | Dec. | Average |
|---------|------|------|------|------|------|------|------|------|-------|------|------|------|---------|
| 1901... | ...  | 44.2 | 48.0 | 61.6 | 71.6 | 78.7 | 74.4 | 65.2 | 54.6  | 38.1 | 33.6 | ...  | ...     |
| 1902... | 30.7 | 26.0 | ...  | ...  | ...  | ...  | ...  | ...  | ...   | ...  | ...  | ...  | ...     |
| 1903... | ...  | 52.4 | 52.4 | 64.2 | 65.1 | 72.4 | 71.8 | ...  | 53.2  | 36.4 | 25.8 | ...  | ...     |
| 1904... | 25.4 | 28.0 | 44.4 | 48.0 | 61.3 | 69.0 | 71.2 | 69.6 | 65.6  | 52.4 | 40.7 | 31.3 | 50.6    |
| 1905... | 25.9 | 24.8 | 44.9 | 52.8 | 62.8 | 70.4 | ...  | ...  | 65.2  | 54.1 | 39.8 | ...  | ...     |
| 1906... | ...  | ...  | 54.0 | 61.8 | 69.8 | 71.4 | 74.7 | 69.2 | 54.8  | 43.2 | 35.4 | ...  | ...     |
| 1907... | 36.6 | 29.9 | 49.8 | 46.2 | 58.3 | 65.0 | 71.6 | 68.4 | 65.8  | 49.5 | 40.0 | 34.4 | 51.3    |
| 1908... | 29.6 | 31.1 | 46.9 | 54.2 | 62.8 | 69.0 | 74.3 | 71.2 | 65.8  | 54.4 | 40.6 | 34.8 | 52.9    |
| 1909... | 35.6 | 39.5 | 40.9 | 52.7 | 60.8 | 71.2 | 70.1 | 71.0 | 64.2  | 48.8 | 47.4 | 27.0 | 52.4    |
| 1910... | 30.7 | 31.3 | 49.0 | 53.2 | 57.4 | 66.2 | 73.2 | 70.3 | 66.8  | 57.3 | 36.6 | 27.2 | 51.6    |
| 1911... | 34.9 | 34.2 | 34.4 | 49.0 | 64.4 | 69.5 | 72.6 | 73.0 | 67.6  | 55.4 | 40.0 | 38.9 | 52.8    |
| 1912... | 23.0 | 26.4 | 39.2 | 54.0 | 62.0 | 65.9 | 72.6 | 68.0 | 67.5  | 54.4 | 42.0 | 35.7 | 50.9    |
| Means.  | 30.3 | 30.1 | 44.6 | 51.3 | 61.6 | 68.4 | 72.8 | 71.2 | 66.3  | 53.5 | 40.4 | 32.4 | 51.9    |

## Monthly and Annual Precipitation at Mannington.

| Year  | Jan.  | Feb.  | Mar.  | Apr.  | May   | Jun.  | July  | Aug.  | Sept. | Oct.  | Nov.  | Dec.  | Totals |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| 1901  | 0.75  | 2.81  | 8.56  | 5.74  | 3.11  | 4.35  | 3.93  | 3.38  | 0.20  | 5.35  | 3.69  | ..... | .....  |
| 1902  | 2.71  | 1.80  | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | .....  |
| 1903  | ..... | ..... | 3.40  | 3.61  | 3.26  | 6.62  | 4.81  | 1.73  | ..... | 2.20  | 2.63  | 1.68  | .....  |
| 1904  | 1.95  | 1.83  | 5.14  | 3.29  | 3.29  | 4.60  | 2.57  | 4.36  | 2.38  | 1.48  | 0.33  | 2.54  | 33.76  |
| 1905  | 3.61  | 1.50  | 4.83  | 3.01  | 3.97  | 3.08  | ..... | ..... | 2.71  | 5.35  | ..... | ..... | .....  |
| 1906  | ..... | ..... | 4.52  | 2.66  | 4.49  | 4.76  | 4.82  | 2.27  | 2.72  | 1.99  | 5.07  | ..... | .....  |
| 1907  | 8.33  | 2.70  | 5.89  | 3.14  | 4.99  | 4.95  | 6.78  | 3.58  | 3.87  | 2.57  | 3.04  | 3.67  | 53.51  |
| 1908  | 2.31  | 3.55  | 5.86  | 3.53  | 5.62  | 2.03  | 4.56  | 2.86  | 1.42  | 1.29  | 0.80  | 3.25  | 37.08  |
| 1909  | 3.76  | 5.04  | 3.90  | 5.34  | 3.67  | 5.18  | 3.12  | 3.00  | 1.44  | 2.19  | 0.71  | 2.93  | 40.28  |
| 1910  | 7.02  | 3.42  | 0.15  | 2.32  | 4.64  | 3.11  | 4.02  | 2.07  | 4.98  | 1.51  | 2.53  | 2.59  | 38.37  |
| 1911  | 7.78  | 2.24  | 3.07  | 5.65  | 1.69  | 3.14  | 4.66  | 6.72  | 5.99  | 4.77  | 2.51  | 4.09  | 52.31  |
| 1912  | 2.06  | 2.47  | 6.14  | 5.23  | 2.84  | 4.21  | 9.39  | 2.03  | 5.57  | 1.19  | 1.52  | 3.00  | 45.65  |
| Means | 4.39  | 2.53  | 4.12  | 4.38  | 3.85  | 4.05  | 4.90  | 3.51  | 3.40  | 2.32  | 2.14  | 3.25  | 42.84  |

## Snowfall at Mannington.

| Year  | Jan.  | Feb.  | Mar.  | Apr.  | May   | Jun.  | July  | Aug.  | Sept. | Oct.  | Nov.  | Dec.  |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1901  | ..... | 6.0   | 0.4   | 3.0   | 0.    | ..... | ..... | ..... | ..... | 0.    | 3.2   | 3.0   |
| 1902  | 11.0  | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 1903  | ..... | ..... | ..... | T     | 0.    | ..... | ..... | ..... | ..... | T     | ..... | 5.0   |
| 1904  | 7.8   | 2.3   | 0.8   | 1.0   | 0.    | ..... | ..... | ..... | ..... | 0.    | 0.7   | 9.0   |
| 1905  | 23.9  | 4.8   | 1.2   | T     | 0.    | ..... | ..... | ..... | ..... | 0.    | ..... | ..... |
| 1906  | ..... | ..... | ..... | 0.    | 0.    | ..... | ..... | ..... | ..... | 2.1   | 2.8   | 5.5   |
| 1907  | 7.2   | 11.9  | 3.1   | 7.8   | ..... | ..... | ..... | ..... | ..... | 0.    | 1.0   | 4.7   |
| 1908  | 9.4   | 10.0  | 1.6   | 0.1   | T     | ..... | ..... | ..... | ..... | 0.    | 2.7   | 6.8   |
| 1909  | 11.8  | 1.9   | 5.3   | 1.6   | T     | ..... | ..... | ..... | ..... | 0.    | 0.6   | 10.2  |
| 1910  | 21.3  | 13.3  | 0.2   | 0.5   | 0.    | ..... | ..... | ..... | ..... | 0.4   | 2.9   | 14.1  |
| 1911  | 4.5   | 2.6   | 8.0   | 3.4   | 0.    | ..... | ..... | ..... | ..... | 0.    | 1.8   | 5.4   |
| 1912  | 10.6  | 4.5   | 3.2   | 0.3   | 0.    | ..... | ..... | ..... | ..... | 0.    | 0.6   | 4.9   |
| Means | 11.9  | 6.4   | 2.6   | 1.6   | T     | ..... | ..... | ..... | ..... | 0.2   | 1.8   | 6.9   |

## Monthly and Annual Mean Temperatures at Grafton.

| Year  | Jan. | Feb. | Mar. | Apr. | May   | Jun.  | July  | Aug. | Sept. | Oct. | Nov. | Dec. | Average |
|-------|------|------|------|------|-------|-------|-------|------|-------|------|------|------|---------|
| 1892  | 26.2 | 35.8 | 35.9 | 50.2 | 62.1  | 75.2  | 73.7  | 72.2 | 64.4  | 51.3 | 40.1 | 30.0 | 51.5    |
| 1893  | 22.3 | 34.9 | 41.0 | 54.3 | 60.0  | 69.8  | 73.2  | 70.2 | 65.6  | 55.0 | 41.4 | 36.4 | 52.0    |
| 1894  | 37.0 | 32.8 | 46.5 | 50.0 | 61.9  | 69.5  | 72.0  | 70.4 | 68.8  | 55.6 | 39.0 | 36.0 | 53.3    |
| 1895  | 28.2 | 20.1 | 38.7 | 52.4 | 61.0  | 72.0  | 68.9  | 72.2 | 69.5  | 48.6 | 46.0 | 36.0 | 51.1    |
| 1896  | 30.8 | 31.3 | 33.4 | 59.2 | 68.2  | 69.2  | 72.3  | 71.8 | 65.4  | 50.3 | 46.8 | 34.0 | 52.7    |
| 1897  | 27.4 | 35.4 | 45.4 | 50.4 | 56.2  | 67.7  | 73.4  | 69.5 | 65.5  | 58.8 | 43.2 | 35.6 | 52.4    |
| 1898  | 34.8 | 32.2 | 47.8 | 46.2 | 62.0  | 69.7  | 73.7  | 72.6 | 67.0  | 55.6 | 42.8 | 33.8 | 53.2    |
| 1899  | 34.0 | 26.4 | 42.6 | 53.2 | 64.0  | 70.1  | 72.8  | 72.2 | 63.1  | 57.8 | 45.6 | 32.7 | 52.9    |
| 1900  | 34.0 | 29.4 | 36.4 | 45.0 | 62.0  | 70.4  | 73.5  | 74.4 | 70.6  | 65.9 | 54.5 | 0.3  | 53.3    |
| 1901  | 31.9 | 23.4 | 42.0 | 44.8 | 59.1  | 68.9  | 76.1  | 72.1 | 63.4  | 53.8 | 35.4 | 32.9 | 50.3    |
| 1902  | 29.2 | 25.2 | 43.8 | 48.8 | 63.8  | 65.8  | 72.8  | 69.0 | 64.7  | 56.4 | 51.1 | 33.4 | 52.0    |
| 1903  | 32.6 | 33.3 | 51.2 | 51.6 | 64.8  | 64.2  | 71.6  | 71.2 | 65.4  | 54.4 | 38.3 | 26.4 | 52.1    |
| 1904  | 28.4 | 29.6 | 44.2 | 47.8 | 61.8  | 69.0  | 70.6  | 69.9 | 67.4  | 54.9 | 41.2 | 32.8 | 51.5    |
| 1905  | 25.7 | 25.1 | 46.4 | 51.8 | 63.7  | 70.0  | 73.1  | 71.4 | 65.5  | 54.8 | 42.0 | 36.2 | 52.1    |
| 1906  | 39.0 | 32.4 | 37.6 | 53.0 | 61.9  | 69.8  | 72.2  | 76.4 | 70.0  | 55.2 | 44.2 | 36.2 | 53.9    |
| 1907  | 38.6 | 30.8 | 49.8 | 45.0 | 58.4  | 64.8  | 71.1  | 68.6 | 66.1  | 49.6 | 42.0 | 36.1 | 51.7    |
| 1908  | 31.6 | 31.4 | 47.4 | 53.8 | 62.2  | 68.0  | 73.8  | 70.6 | 66.8  | 56.5 | 43.9 | 35.7 | 53.5    |
| 1909  | 37.4 | 40.3 | 40.6 | 53.2 | ..... | ..... | ..... | 71.6 | 64.6  | 50.3 | 49.0 | 28.5 | .....   |
| 1910  | 32.6 | 32.2 | 50.1 | 53.8 | 58.6  | 67.0  | 74.1  | 70.3 | 68.8  | 58.6 | 37.0 | 27.9 | 52.6    |
| 1911  | 38.0 | 40.2 | 42.6 | 50.2 | 66.2  | 71.4  | 74.9  | 74.4 | 70.2  | 58.7 | 42.2 | 41.7 | 55.9    |
| 1912  | 25.4 | 27.7 | 41.2 | 56.5 | 65.2  | 68.7  | 74.4  | 70.2 | 70.4  | 57.1 | 43.3 | 38.0 | 53.2    |
| Means | 31.7 | 30.9 | 43.1 | 51.3 | 62.2  | 69.1  | 72.9  | 71.4 | 66.8  | 54.9 | 42.8 | 34.0 | 52.6    |

Monthly and Annual Precipitation at Grafton.

| Year  | Jan. | Feb. | Mar. | Apr. | May   | Jun.  | July  | Aug.  | Sept. | Oct. | Nov. | Dec. | Totals |
|-------|------|------|------|------|-------|-------|-------|-------|-------|------|------|------|--------|
| 1891  | 4.69 | 2.87 | 2.57 | 4.56 | 5.37  | 2.67  | 3.32  | 1.87  | 3.39  | 1.45 | 3.91 | 3.00 | 39.67  |
| 1892  | 2.57 | 4.73 | 1.13 | 7.17 | 4.07  | 4.06  | 3.68  | 1.76  | 1.51  | 2.95 | 2.59 | 1.71 | 37.93  |
| 1894  | 2.51 | 3.84 | 1.82 | 4.13 | 3.98  | 2.96  | 4.34  | 3.05  | 1.73  | 2.32 | 2.40 | 4.74 | 37.82  |
| 1895  | 4.67 | 1.24 | 3.80 | 4.15 | 1.65  | 4.55  | 3.65  | 3.48  | 0.44  | 1.61 | 2.27 | 2.23 | 33.77  |
| 1896  | 1.50 | 2.96 | 4.70 | 2.18 | 4.84  | 4.01  | 11.91 | 2.22  | 4.68  | 2.83 | 3.38 | 2.00 | 47.21  |
| 1897  | 2.21 | 5.27 | 3.43 | 3.10 | 4.81  | 5.15  | 6.24  | 2.82  | 0.65  | 0.32 | 4.89 | 4.96 | 43.85  |
| 1898  | 5.58 | 2.45 | 7.14 | 4.05 | 4.73  | 4.48  | 4.36  | 6.85  | 1.87  | 4.92 | 3.34 | 2.45 | 52.25  |
| 1899  | 4.87 | 3.43 | 5.51 | 1.84 | 4.71  | 6.33  | 4.68  | 2.10  | 4.74  | 1.21 | 3.34 | 3.22 | 45.98  |
| 1900  | 2.17 | 3.95 | 3.77 | 1.66 | 2.72  | 5.40  | 5.09  | 5.40  | 0.98  | 3.63 | 6.18 | 2.55 | 43.50  |
| 1901  | 2.53 | 0.73 | 3.63 | 6.51 | 6.50  | 9.37  | 3.32  | 5.30  | 3.56  | 0.43 | 3.12 | 4.44 | 49.44  |
| 1902  | 3.82 | 2.38 | 5.14 | 3.50 | 5.02  | 5.68  | 4.82  | 4.80  | 4.68  | 2.92 | 3.11 | 6.86 | 52.74  |
| 1903  | 2.57 | 5.65 | 5.77 | 3.70 | 3.74  | 4.96  | 3.75  | 2.28  | 1.49  | 3.42 | 3.62 | 2.28 | 43.23  |
| 1904  | 2.54 | 2.22 | 5.36 | 3.77 | 2.60  | 4.94  | 1.60  | 3.45  | 2.94  | 1.55 | 0.30 | 2.93 | 34.20  |
| 1905  | 3.28 | 1.44 | 5.78 | 4.13 | 4.81  | 5.05  | 7.92  | 5.57  | 2.34  | 5.08 | 2.85 | 3.15 | 51.40  |
| 1906  | 3.27 | 1.61 | 5.57 | 5.05 | 2.99  | 4.76  | 2.30  | 3.07  | 2.67  | 2.98 | 2.56 | 5.59 | 42.42  |
| 1907  | 2.70 | 2.98 | 5.43 | 2.41 | 5.12  | 4.40  | 8.01  | 5.61  | 5.94  | 4.09 | 3.92 | 3.38 | 58.99  |
| 1908  | 2.23 | 3.66 | 6.65 | 3.76 | 7.65  | 2.87  | 4.48  | 2.29  | 0.74  | 0.50 | 0.70 | 2.94 | 37.97  |
| 1909  | 3.80 | 4.82 | 2.76 | 5.09 | ..... | ..... | ..... | 3.18  | 2.64  | 3.45 | 1.23 | 2.52 | .....  |
| 1910  | 9.02 | 4.80 | 0.38 | 2.94 | 3.78  | 4.17  | 5.15  | 2.01  | 4.41  | 2.64 | 3.57 | 3.94 | 46.81  |
| 1911  | 8.36 | 2.58 | 2.94 | 4.45 | 1.47  | 4.19  | 5.02  | 11.50 | 5.44  | 5.26 | 1.91 | 3.70 | 56.82  |
| 1912  | 3.40 | 2.95 | 6.56 | 3.95 | 3.79  | 3.45  | 7.14  | 3.13  | 5.02  | 1.56 | 1.84 | 3.51 | 46.30  |
| Means | 3.73 | 3.17 | 4.28 | 3.91 | 4.22  | 4.67  | 5.04  | 3.89  | 2.95  | 2.60 | 2.91 | 3.43 | 44.80  |

Snowfall at Grafton.

| Year  | Jan. | Feb. | Mar. | Apr. | May   | Jun.  | July  | Aug.  | Sept. | Oct.  | Nov. | Dec.  |
|-------|------|------|------|------|-------|-------|-------|-------|-------|-------|------|-------|
| 1893  | 25.2 | 4.0  | 7.5  | 1.5  | ..... | ..... | ..... | ..... | ..... | ..... | 1.5  | 3.2   |
| 1894  | 11.5 | 21.3 | 2.0  | 1.5  | ..... | ..... | ..... | ..... | ..... | ..... | 4.2  | ..... |
| 1895  | 17.0 | 13.1 | 16.2 | 0    | T     | ..... | ..... | ..... | ..... | ..... | 0.8  | 6.8   |
| 1896  | 2.6  | 7.0  | 27.6 | 0.5  | ..... | ..... | ..... | ..... | ..... | T     | T    | 3.5   |
| 1897  | 8.8  | 3.6  | 4.1  | T    | 2.2   | ..... | ..... | ..... | ..... | ..... | 0.5  | 4.3   |
| 1898  | 4.0  | 8.9  | 10.0 | 4.9  | ..... | ..... | ..... | ..... | ..... | T     | 6.9  | 10.5  |
| 1899  | 10.0 | 13.5 | 5.0  | T    | ..... | ..... | ..... | ..... | ..... | ..... | T    | 3.5   |
| 1900  | 2.0  | 9.0  | 12.5 | T    | ..... | ..... | ..... | ..... | ..... | ..... | 3.0  | T     |
| 1901  | 9.0  | 4.2  | 3.8  | 11.0 | ..... | ..... | ..... | ..... | ..... | ..... | 5.0  | 5.5   |
| 1902  | 14.2 | 9.5  | 19.8 | 22.0 | ..... | ..... | ..... | ..... | ..... | T     | 1.5  | 16.0  |
| 1903  | 5.8  | 9.8  | T    | T    | T     | ..... | ..... | ..... | ..... | T     | 10.5 | 12.5  |
| 1904  | 14.9 | 8.0  | 1.6  | 3.0  | ..... | ..... | ..... | ..... | ..... | ..... | 2.0  | 11.3  |
| 1905  | 26.2 | 8.2  | 0.8  | 1.5  | ..... | ..... | ..... | ..... | ..... | T     | 0.2  | 2.8   |
| 1906  | 4.0  | 6.0  | 16.5 | 0.5  | T     | ..... | ..... | ..... | ..... | 5.0   | 3.5  | 10.5  |
| 1907  | 6.0  | 11.0 | 5.0  | 4.0  | 0     | ..... | ..... | ..... | ..... | 0     | 1.0  | 5.5   |
| 1908  | 16.8 | 9.0  | T    | 0.5  | 0     | ..... | ..... | ..... | ..... | 0     | 4.2  | 5.6   |
| 1909  | 10.9 | 3.0  | 3.5  | 1.5  | T     | ..... | ..... | ..... | ..... | 0     | T    | 6.7   |
| 1910  | 11.0 | 13.5 | 0.2  | 0    | 0     | ..... | ..... | ..... | ..... | 1.0   | 3.0  | 18.5  |
| 1911  | 10.0 | 7.5  | 2.1  | T    | 0     | ..... | ..... | ..... | ..... | 0     | 1.0  | ..... |
| 1912  | 16.8 | 5.0  | 5.2  | 0    | 0     | ..... | ..... | ..... | ..... | 0     | T    | 5.0   |
| Means | 11.3 | 8.8  | 6.7  | 2.6  | 0.1   | ..... | ..... | ..... | ..... | 0.3   | 2.4  | 7.3   |

## Highest Temperatures.

| Stations      | Length of Record Years | Jan. | Feb. | March | April | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. | Annual |
|---------------|------------------------|------|------|-------|-------|-----|------|------|------|-------|------|------|------|--------|
| Grafton.....  | 18                     | 75   | 80   | 84    | 92    | 92  | 99   | 96   | 96   | 98    | 91   | 79   | 71   | 99     |
| Mannington... | 12                     | 70   | 68   | 87    | 91    | 93  | 99   | 101  | 98   | 94    | 88   | 79   | 70   | 101    |
| Morgantown..  | 18                     | 76   | 80   | 90    | 93    | 94  | 99   | 101  | 105  | 102   | 94   | 80   | 80   | 105    |

## Lowest Temperatures.

| Stations      | Length of Record Years | Jan. | Feb. | March | April | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. | Annual |
|---------------|------------------------|------|------|-------|-------|-----|------|------|------|-------|------|------|------|--------|
| Grafton.....  | 18                     | -15  | -27  | 0     | 9     | 21  | 38   | 42   | 42   | 31    | 17   | 7    | -5   | -27    |
| Mannington... | 12                     | -31  | -18  | -5    | 16    | 25  | 34   | 45   | 40   | 30    | 17   | 1    | -14  | -31    |
| Morgantown..  | 18                     | -11  | -25  | -4    | 8     | 28  | 37   | 44   | 44   | 33    | 15   | 9    | -16  | -25    |

## Frost Data.

| Stations      | Length of Record Years | Average Time of First Killing Frost in Autumn | Average Time of Last Killing Frost in Spring | Earliest Date of Killing Frost in Autumn | Latest Date of Killing Frost in Spring |
|---------------|------------------------|---|--|--|--|
| Grafton.....  | 18                     | Oct. 7  | Apr. 30                                      | Sep. 21                                  | May 22                                 |
| Mannington... | 12                     | Oct. 10                                       | May 6  | Sep. 28                                  | May 28                                 |
| Morgantown..  | 18                     | Oct. 13                                       | May 1  | Oct. 2                                   | May 22                                 |

These figures represent with fair accuracy the average conditions obtaining in the area. The mean annual temperature is 53° F. The summers are pleasant, though in the valleys the temperature is often rather high, though rarely exceeding 100° F. An absolute maximum of 105° F. has been recorded in August and of 102° F. in September. The winters are moderately cold, the seasonal mean being 32°. Sharp cold spells occur, but are of comparatively short duration. The lowest temperature recorded is — 31° F. The average date of occurrence of last killing frost in the spring falls in the first week of May and of the first in the fall in the second week of October. The growing season is thus of sufficient length for all crops grown in this general region to mature.

The mean annual rainfall amounts to 41 inches and the precipitation does not vary much from year to year. It is fairly well distributed, though in later summer and fall droughts occur and in that case it is not infrequently difficult for fall-sown grain and grass to make satisfactory growth before the setting in of cold weather. A part of the precipitation is in the form of snow, the average depth amounting to 29.4 inches, or if reduced to rain somewhat more than 2 inches.

The climate is healthful and numerous summer tourists spend the warm season in the mountainous section of the northeastern part of the area.

### AGRICULTURE.

The agricultural development of this section was slow, barely keeping pace with the increase in population, as outside markets were remote and no satisfactory means of transportation existed. Conditions were improved somewhat by the construction of the State road about 1800, which passed through this section, bringing increasing numbers of settlers into the area and making it possible to get more of the products of the farm out by wagon. The construction of other turnpikes followed, and considerable trade passed over these roads.

During this period agricultural production was gradually increasing and the clearing of new land constantly carried on. Corn, wheat, rye, oats, buckwheat, and potatoes were the staple crops, and by 1840 their output had reached considerable proportions. These crops, with exception of rye, have continued the staple crops of the area to the present time. Since 1880 the acreage devoted to rye has decreased rapidly, and only a few acres are now grown in the three counties. The production of corn has increased, and so in general has the production of wheat. The production of buckwheat reached a maximum in Monongalia County in 1859. It is still grown to considerable extent, but the acreage varies greatly from year to year. The production of potatoes has from the first shown a steady increase.

Stock raising dates from the early days of settlement, when cattle and sheep raising was an important industry. The

section is well adapted to grazing, bluegrass being indigenous to at least a part of the soils. Sheep were at first brought in to furnish wool for clothing, but as the climate and grazing were favorable this branch of stock raising became profitable on a larger scale, especially in the western part of the area. The industry reached its highest mark in 1880, and since that time has gradually declined. The fattening of lambs, sheep, and beef cattle has taken the place of wool growing. The limestone land (Westmoreland silty clay loam) and the soils of the Permo-Carboniferous or Dunkard formation (Meigs clay loam) are especially suited to grasses, seeding to bluegrass naturally. The former was largely devoted to cattle grazing, while the latter especially was well suited to sheep.

The tree fruits were introduced shortly after settlement, and the apple especially has thrived, but its production has never exceeded the needs of home consumption.

The development of the oil and gas resources soon after 1890, especially in Monongalia and Marion Counties, has taken much attention from the farms. Much labor has turned to the new fields, and landowners have necessarily curtailed their operations and now depend more upon the rentals and royalties they receive, which in most cases far exceed the profits of the farm. Under these conditions agricultural production has come practically to a standstill, and more land is in grass, although the number of cattle grazed has not increased, for while there is plenty of pasture the number of stock kept is dependent upon the grain and hay that can be produced to feed them through the winter months.

The agriculture of the area is of a mixed type. It is based upon stock grazing, with general farming to produce the crops required to carry the cattle over the winter. The finished beeves form the chief source of income. The average farm, as a rule, does not produce sufficient to meet its requirements, especially of grain, and very little grain or hay is sold at the local markets. Larger quantities are shipped into the area. The production of these staple crops is confined principally to the valleys. The steep hillsides make up most of the grazing lands.

Corn is the main crop and good yields are made on the

bottomland soils. Some of the better upland slopes are also used for this crop. The acreage in this crop is larger than that devoted to any other crop except hay. For the three counties the yield of corn per acre is about 30 bushels. Wheat leads the small grains, the acreage devoted to it being quite constant, and averaging about three-fourths the acreage in corn. According to the census the average yield is about 10 bushels per acre. The oat crop is also important. The average yield is low, however, ranging from 15 to 20 bushels per acre.

The acreage in buckwheat has varied considerably in the past, but is now increasing, as the demand for the flour has made it a profitable crop. It is practically restricted to the eastern part of the area, where the altitude and the soils are better suited to its production than elsewhere. This crop usually follows wheat or oats, being planted in July. Two crops of buckwheat, however, can be taken from the same ground in a single season, and this is done by a few farmers. The yields range from 10 to 35 bushels per acre.

The total production of potatoes is considerable, but the crop is grown mainly in small patches to supply the family needs. In the eastern part of the area it is a more important crop, being grown for the local markets. The supply is not equal to the demand, as potatoes are shipped into the area in large quantities. There is a large area of land that could be devoted to this crop. The Elk silt loam, in the Monongahela Valley will be found particularly well adapted for potato production. At least enough potatoes should be produced to meet the local demands.

The acreage in grass and other forage crops cut for hay is about the same as that devoted to all cultivated crops combined. Timothy, redtop, and clover are the principal hay crops. Clover is usually sown with the other grasses. Redtop is gaining in favor, as it gives good stands. It does not cut so heavy a crop as timothy or orchard grass. On the bottoms and lower slopes, where good moisture conditions prevail, orchard grass is sometimes sown and does well, making a heavy yield of hay. The average yield of hay over the three counties is a little less than 1 ton to the acre. On the bottoms and the more or less calcareous soils the yield is higher, but the



average is lowered by the thinner and inferior soils. The millets are gaining in favor and patches and fields in some sections are quite numerous. The yield is heavy.

Cowpeas are grown to some extent and should receive more attention, as they are a valuable forage crop and a soil improver as well. A few small patches of alfalfa have been tried with indifferent success. On the calcareous soil, with proper treatment, this crop should succeed.

Of the improved land in farms in Monongalia and Taylor Counties about one-fourth is devoted to cultivated crops and grasses cut for hay, while in Marion County the proportion is larger, being about one-third, there being less rough land in this county than in the others. The remaining improved land is probably in more or less permanent pasture.

Some dairying is done in the vicinity of the larger towns, but the supply of milk is barely sufficient to meet the local demands. The purebred Jerseys and Holsteins, the former introduced as early as 1878 and the latter within comparatively recent years, with some good grades constitute the dairy stock.

The high prices for poultry products during the last few years have given a stimulus to this industry and poultry raising is increasing in importance both for egg and meat production.

Apple orchards are said to have existed as early as 1779. Fruit growing in the area, however, has not been developed on a commercial scale. A few trees are to be found on most farms, but only to supply the family. These are not given attention except in a few instances. The few small orchards that are given good cultural treatment and sprayed have proven profitable to the growers. There is a wide range in varieties suited to this section, including the summer, fall, and winter apples. There are plenty of good orchard sites to be found in the area.

Blackberries, raspberries, and strawberries do well in this section, but their growth is limited to small home patches. A few patches of berries produced for market have paid good profits and the small fruits should receive more attention. The high terraces along the Monongahela would be especially adapted to their cultivation.

Vegetables are limited practically to the home gardens.

There is an excellent opportunity to develop trucking in this section, as there is a strong and growing demand for vegetables, which are now shipped in instead of being produced locally. From the first of July until the frost comes growers could meet all outside competition if an effort were made to supply the local markets. The Elk silt loam, a terrace soil, is well suited for producing the truck crops, of which a wide range could be grown. The heavier crops would doubtless prove more profitable because of the local demand for this class of produce.

As noted already the development of the oil and gas resources of the area has diverted interest from farming to a large extent. This is due in part to the labor going into those fields, where high wages are paid. The development of coal mining has had practically no effect upon the supply of farm labor, as the labor in the mines is nearly all performed by foreigners unskilled in farm work. The output of the farms could be increased, however, with the labor still available, should the owners exert themselves in that direction. Where the oil and gas fields are giving out or tests have not disclosed any new deposits the owners are being forced to return to their farming and are taking up the work with renewed interest.

The upland farms are much more difficult to manage than the valley farms, as more hand labor is required. Though improved farm implements are employed wherever possible, there is much land where machinery can not be used. Improved machinery of all kinds is found on the valley farms. On the hillsides contour cultivation is necessary to prevent washing. Great care is necessary in farming slopes, as they wash easily. In the early days very little care was taken to protect the land, as there was plenty of new lands available, so that fields were cropped continuously until "worn out" and then abandoned and soon taken by grass. While some crop their fields continuously, the practice is not favored now. To keep the fields from washing the slopes are kept in grass as much as possible. The roots in newly cleared land and sod will hold the soil for one or two cultivated crops and then it must be seeded to grass. Soil erosion is also lessened by hav-

ing different crops on the slopes. Strips of cultivated ground are alternated with strips in sod. There is thus a kind of crop rotation followed on the upland slopes, but none is strictly adhered to, the period in grass being indefinite. The usual practice is sod land plowed and planted to corn for one season and rarely for two, followed by oats, then by wheat, in which timothy and redtop are sown, and in the spring usually clover. The grass is cut for hay until the yields become unprofitable and is then pastured for an indefinite period, usually as long as the grass holds well. Potatoes in the eastern part of the area find a place as a cultivated crop in the rotation with corn. Buckwheat in the eastern part is used as a crop following oats or as a catch crop for areas where some other crop has failed to germinate properly. Shorter crop rotations where the land is easily tilled are advisable and variations in the rotation can be made to suit the different conditions.

On the bottom lands no rotation is practiced, corn being practically the only cultivated crop. Yields are maintained by applications of manure. In the crop rotations on all the soils of the area a legume should always find a place.

The practice of cropping, especially in the early days, was destructive, little thought being given to maintaining the soil fertility. As crop yields later decreased fertilization was resorted to. Barnyard manure was always saved and used, and liming was a common practice. As early as 1855 guano was used with good results, and this was soon followed by commercial fertilizers, consisting of ammoniated phosphates, the phosphate carrier being phosphate rock or bone meal, the latter preferred. An increase in yields of nearly 33 per cent was reported on the depreciated lands. Barnyard manure followed by lime was considered the cheaper treatment and produced the most satisfactory results.

With the development of the mineral resources and decline of agriculture the use of fertilizers, particularly the commercial brands, was discontinued and even liming was not so common. At the present time and on most of the soils of the area, except those of the western section, or the soils derived from the Permian formation (Meigs clay loam) the use of com-

mercial fertilizers has once more become general. On the latter soils it is said the improvement does not warrant the additional expense. The use of fertilizers on the limestone land (Westmoreland silty clay loam) is not common, but on the different soils of the Dekalb series some form of commercial fertilizer is used almost without exception. These Dekalb soils are thin and fertilization is necessary to secure anything like a fair yield. The fertilizer practice, however, has not reached any settled basis, the farmers using different kinds largely upon the advice of dealers. As a result accurate information on this question is not at present available. For corn, wheat, and oats a fertilizer having a formula of 8-2-2 is generally used.

Potatoes are usually fertilized with an 8-4-2 mixture. The proportion of potash should be higher than this in order to get the best results. The same mixture is also used by some for garden vegetables. For grass a fertilizer high in phosphoric acid, with small quantities of potash, is applied by some farmers. Ground bone has from the first been popular for the cereals and grasses. There is considerable variation in proportions of the several salts in the mixtures used for these crops, generally in the quantity of phosphoric acid and to less extent in potash. Very often the fertilizer mixture is made of 8 per cent phosphoric acid, 2 per cent nitrogen, and 2 per cent potash. Fertilizers are used on all crops except on meadows and permanent pastures, the grass getting an application at the time of sowing with small grains. The quantity of fertilizer used in the general practice of the region is small, ranging from 100 to 200 pounds to the acre. Where pastures can not be conveniently broken they may be improved by applications of finely ground rock phosphate or floats.

Experiments conducted by the State experiment station show that phosphates are the controlling factor in the treatment of soils of this region. Potash is necessary in potato production.

The experiment station after a series of trials during a number of years finds the most satisfactory results where the soils had been limed and barnyard manure applied annually.

There is some liming done at present, especially where suitable limestone is found near at hand and can be burned on the place. All the soils, according to the farmers, respond readily to the use of lime. It should be used, however, in connection with applications of organic manures, either barnyard manure or a green manuring crop, preferably a legume. The soils are generally deficient in organic matter and any system of soil management should be planned to supply it in some form. Stable manure should be carefully protected from leaching, and, where this is not possible, it should be spread on the land as rapidly as it is made.

The farms vary considerably in size, from holdings of a few acres to several hundred acres, the average for the three counties, as shown by the last census, ranging between 90 and 100 acres. There has been little change in size for some decades. Renting of farms is not a common practice, the owners either tilling the farms themselves or superintending the work. The census of 1900 shows that of the total number of farms in the area between 80 and 82 per cent are operated directly by the owners themselves. When rented it is usually on a share basis, but the terms of leases vary greatly. A number of farms are operated by hired managers.

Labor is scarce but efficient and commands good wages. Under the present conditions little farm labor is required, except at special seasons, such as harvesting time.

Farm values have increased considerably in the last few years, the surface rights alone bringing now as much as they did formerly when oil, gas, and coal were included. The sale of the oil or gas rights and the rentals and royalties therefrom and the sale of the workable seams of coal have put most farmers in fairly good circumstances. While not working the farms to best advantage, they have improved them by the erection of good dwellings and outbuildings, and consequently there is often an appearance of prosperity which is not in keeping with the character of the land. The value of farm lands ranges from \$5 an acre for the poorer and more remote farms to \$100 an acre for farms located on better soils near towns. There is very little land on the market.

## SOILS.

The soils found in the area fall into two main groups—residual soils of the upland and transported soils of the stream bottoms and terraces. Exclusive of areas of Rough stony land 10 distinct types of soil were mapped.

The upland types are the most extensive, covering fully 90 per cent of the area surveyed. They are derived from the underlying rocks by the ordinary processes of weathering. The rock formations are of sedimentary origin and of Carboniferous age. They comprise a great variety of interbedded shales, sandstones, and limestones, including some coal seams. The materials forming these rocks having been deposited by water were laid down horizontally, but during a later period they were given a gentle tilt westward in the area as a whole, and at the same time were bent into a number of low anticlines and shallow synclines. The only one of these strong enough to have any significance in soil formation was the one that formed Chestnut Ridge. When formed it was a ridge and because of this it has been more vigorously attacked by erosion than has the plateau surface on either side of it. It has not yet been reduced to the general level of the surrounding country, but deeper lying rocks have been uncovered along it than elsewhere. These have weathered into soils differing from those found over the plateau in general. The general westward dip of the beds has caused the occurrence on the surface of the younger beds in the western part of the area and of successively older beds eastward.

From the lowest rock exposed in the area—the beds uncovered where the Cheat River Valley cuts Chestnut Ridge—to the highest bed of rock exposed there is a total thickness of about 3,000 feet. This section is made up of five formations, named in the order of their age, from the youngest to the oldest, the Dunkard, Monongahela, Conemaugh, Allegheny, and Pottsville. The Pocono and Pottsville sandstones and the Greenbrier limestone are resistant rocks and give rise to areas of rough stony land of no value except for the forest growth. Thus only the Dunkard, Monongahela, Conemaugh, and

Allegheny formations form soils of agricultural value. The soils thus formed are of silty texture on the surface, with clay loam, silty clay loam, or silty clay subsoils.

These soils are all very similar in texture, but differ somewhat in color and especially in agricultural value. These differences depend mainly upon the character of rocks from which the soils were derived and to some extent upon their general topography.

The Dunkard formation occurs in the western half of Marion and Monongalia Counties. It is composed of interbedded gray and brown shales and sandstones, with thin beds of red shales. The weathering of these rocks gives rise to the Meigs clay loam, which, owing to the different varieties of rocks from which it is derived, varies in color from grayish to light brown, with strips and patches of Indian red. In the eastern part of the area the Dunkard formation has been eroded away, exposing the next underlying formation, the Monongahela. Some Dunkard outliers are found capping the tops of ridges and knobs, but the rock is so much like the upper 100 feet of the Monongahela rocks that the resulting soils are the same for these parts of both formations. These soils have a decidedly yellow subsoil and are designated Dekalb. Shale strata predominate in this part of the formation and give rise to a smoother and more rounded topography than that of the Meigs soil region, and produce also only one type of soil, the silty clay loam.

The rest of the Monongahela formation and part of the Conemaugh in the area, as in the counties immediately south of it, is composed in part of a number of limestone beds and calcareous shales interbedded with gray shales and to a less extent with sandstones. The weathering of these rocks has resulted in a relatively smooth topography. The belt is quite noticeable, aside from its topography, by the generally better growth of grass and the more thrifty appearance of the farms.

These rocks have given rise to gray soils, with yellow subsoils, known in soil classifications of the region as the Westmoreland soils. They are called locally "limestone lands." In this area there is only one type of the series and it is found

along the Monongahela River in Marion and Monongalia Counties and in western and southwestern Taylor County. While a certain part of the Monongahela and Conemaugh formations may be expected to carry limestones, there are exceptions. From Fairmont north on the east side of the Monongahela River the limestones are in part or wholly lacking. East of the Monongahela, where the Pittsburgh coal is rising and is in the tops of the hills, it is capped by massive sandstone, which gives rise to the Dekalb silt loam. Elsewhere where the coal vein is lower limestone is found to 280 feet above the Pittsburgh coal or the top of the Uniontown limestone. This latter is the most constant factor of the type. The limestones are lacking or unimportant as affecting the soils below the Pittsburgh coal formation. Usually, however, the limestone land is found to the horizon of the Clarksburg limestone, 165 feet below the Pittsburgh coal. In southern Marion and in western and southwestern Taylor counties the limestone strata are sufficient to give character to the land to a level 350 feet below the Pittsburgh coal.

The formations below the limestone-bearing strata in this area consist of shales and sandstones, the sandstones as a whole predominating. These give rise to Dekalb soils and on account of the abundance of resistant sandstone present Rough stony land occurs in large areas, though the shales as elsewhere produce fine-grained soils.

As a whole the upland soils in this area exhibit a strikingly close relation to the character of the rock on which they lie. The rock beds dip gently westward. The general upland surface slopes gently westward also, but not so rapidly as the dip of the rock beds. The surface plane therefore cuts the rock planes in such a way that the youngest beds occur in the western part of the county. The underlying formations down to the Pocono sandstone outcrop in successive north-south belts east of this, the most easterly belt being the Pocono belt in Chestnut Ridge.

The highest formations contains a great deal of red shale interbedded with sandstones and gray shales, resulting in an



intimate association of red and gray or yellow soils, which are grouped together as Meigs.

East of this lies a belt of rocks free from red shales. They weather into gray soils with yellow subsoils, the Dekalb. East of this belt lies a belt of alternating shales, sandstones, and thin limestones. These weather into soils indistinguishable in appearance from Dekalb soils, but more productive, the Westmoreland soils. The next belt eastward is free from red shales and limestones and produces Dekalb soils, but the abundance of massive resistant sandstones produce a great deal of stony soil.

The transported soils consist of first bottoms along streams and the high terraces in places bordering the Monongahela and other large streams. The terrace material was deposited when the water stood at higher levels. The original flat surface of these has been more or less dissected by erosion since the stream water dropped to lower levels. The material of the terraces along the Monongahela includes wash from soils derived from limestone, calcareous shales, shales, and sandstones. Such areas have been classed as Elk silt loam. The Holston silt loam is very similar to the Elk in color and texture, but it includes less limestone and calcareous shale material, for the soils of the drainage basins of its streams are primarily derived from shale and sandstone. It is found most extensively along Dunkard Creek and in a few places along some of the other larger creeks and the rivers. It is a less productive soil than the Elk silt loam.

The Tyler silt loam is closely associated with the Holston, and, in fact, represents Holston material that has existed under poor drainage conditions. Its development in the Morgantown area is small.

Two first-bottom types have been developed in the area. The more extensive is the Huntington silt loam, formed along streams depositing the wash from limestone, sandstone, and shale soils. The Moshannon silt loam differs in color from the Huntington, the sediments coming from the red materials occurring in the Meigs clay loam having imparted a reddish or reddish-brown color to the alluvial type. Both of these types

are strong, productive soils, and especially adapted to corn and grass. While nowhere do they occur in large bodies, their extent is considerable in the aggregate and they are of great importance to the agriculture of this section.

The following table gives the names and areas of the various soil types mapped:

Areas of Different Soils.

| Soil.                        | Acres.  | Per cent. | Soil.                     | Acres.  | Per cent. |
|------------------------------|---------|-----------|---------------------------|---------|-----------|
| Dekalb silty clay loam.....  | 204,480 | 36.5      | Huntington silt loam..... | 12,288  | 2.2       |
| Meigs clay loam.....         | 170,368 | 30.4      | Moshannon silt loam.....  | 7,296   | 1.3       |
| Westmoreland silty clay loam | 64,000  | 11.4      | Holston silt loam.....    | 3,200   | .6        |
| Rough stony land.....        | 46,976  | 8.4       | Tyler silt loam.....      | 448     | .1        |
| Dekalb stony loam.....       | 20,224  | 3.6       |                           |         |           |
| Dekalb silt loam.....        | 16,768  | 3.0       | Total .....               | 560,000 | .....     |
| Elk silt loam.....           | 13,952  | 2.5       |                           |         |           |

### Meigs Clay Loam.

The Meigs clay loam comprises undifferentiated Dekalb and Upshur soils, with some areas of an intermediate type—a Dekalb-Upshur soil. Separation of the several types was impracticable owing to their intricate association. A considerable proportion of the soil in this area is not altogether typical of the soil as mapped farther south in the state, where the distribution of the Dekalb, the Upshur, and the intermediate soil is more nearly equal. There are many places in the present area where the Dekalb silt loam and silty clay loam predominate over both the Upshur and the intermediate soil; in fact, it was difficult at times to decide whether to map the soil as Meigs clay loam or as Dekalb silt loam or silty clay loam including some patches of Upshur not differentiated on account of their small extent.

The Dekalb material is prevailingly a silt loam to silty clay loam, about 4 to 8 inches deep, the immediate surface being generally decidedly silty. The color is light brown to grayish brown, grading with depth into a light yellow. The subsoil ranges from a brownish-yellow, moderately compact silt loam to silty clay loam, grading frequently into silty clay at about 15 to 20 inches, the texture persisting usually to the underlying parent rocks. On steep slopes where erosion is active the clay

subsoil is often nearer the surface and in places is even exposed.

The frequent patches of Upshur soil have the characteristic Indian-red color of the series. They occur on the slopes, crests of ridges, and tops of hills over the red shales from which the soil is derived. The Upshur soil consists largely of Indian-red silty clay loam or clay, underlain by stiff, plastic Indian-red clay, having usually a greasy feel. These areas would be classed mainly as the Upshur clay type if they had been large enough or of sufficiently regular shape to map.

Spots are found on slopes where the wash or soil creep from the Dekalb soils above has covered the red clay, thus giving rise to a grayish or light-brown soil with a red clay subsoil—a Dekalb-Upshur type. Along boundaries between the yellow and red or where the shale beds are not thick and prominent the color is reddish yellow or the yellow is mottled with red. In this area the Meigs clay loam is not so typical as it is in the counties mapped to the south because the red materials are not so abundant, although there is still enough of the characteristics of the Meigs clay loam to give the land this classification.

The depth of the soil and subsoil varies considerably, depending upon the position of the areas. On the steep slopes erosion has prevented the accumulation of much soil material over the rock, the strata being exposed in places, or at least very near the surface. Usually the depth to the bedrock is 20 inches or more, and frequently is not encountered within several feet of the surface. Throughout the soil mass and upon the surface occur more or less decomposed fragments of shale and sandstone, though rarely in sufficient quantity to interfere with cultivation.

The Meigs clay loam is one of the extensive soil types of the area. It occurs in almost uninterrupted bodies in western Marion and Monongalia Counties. East of this unbroken belt small areas are scattered through the other soil types in central Marion and Monongalia and in western Taylor Counties. These areas cover the sharp crests of ridges and the hilltops.

The type is characterized by broken to hilly topography,

the surface as a whole being rougher than any other soil type except the Rough stony land. The tops of the ridges are generally narrow and irregular, and the slopes as a rule descend steeply to narrow V-shaped valleys. The elevation of the ridge tops ranges from 300 to 500 feet above the valley floors. A feature of the hillsides is the presence of narrow benches or terraces, caused by massive sandstone beds that have resisted weathering and prevented the formation of uniform slopes. On these benches the soil is generally deeper, more loamy and productive than on the slopes and tops. Over the greater part of the type the slopes are so steep as to make their cultivation difficult. The run-off is rapid, and where not protected by a covering of sod or other vegetation the soil material is washed away, forming erosion gullies. There is little opportunity for the storage of moisture and the type is more or less droughty, crops suffering in ordinary dry spells, except in favored locations. Small springs or seepage places occur in the ravines, but these fail in times of drought, and the small runs fed by them usually go entirely dry also. Even the larger streams have very little flow or cease entirely except for the seepage waters passing from pool to pool through their gravels.

The Meigs clay loam is of residual origin, and derived from a variety of sedimentary rocks of Upper-Carboniferous age. The Dunkard formation gives rise to most of this type, although the upper Monongahela formation enters to some extent, especially in the eastern section of the area. These formations consist of a series of interbedded shales, sandstones, and some thin or shaly limestone, coal seams, and accompanying fire clays. Some of the sandstones are fine and some coarse, some massive, and some thin bedded and shaly. The shales also vary from thin to thick bedded and from argillaceous to sandy. Gray shales and sandstones and the red shales give rise to most of the material forming this type.

Although the Meigs clay loam is steeply broken, the greater part of it is cleared and has been under cultivation for some time. The object in clearing this land has been to furnish pasturage, as it is fairly good for grasses. Bluegrass does well on most of it, although rather short lived, except upon phases

of soil particularly adapted to its growth. North and east slopes are much the better pasture land and are also better for the cultivated crops. Southern and western slopes, through longer exposure to the sun's rays, dry out more quickly. In changing this land from its natural forested condition to pasture, care must be taken to prevent erosion. When newly cleared the soil is full of roots, which ordinarily hold its sufficiently for a few years, or until the grasses form a protective sod, but it will not do to grow too many intertilled crops before seeding down.

Corn is the first crop grown and in the early days was planted until the yield had decreased, when small grains, with which the grasses were seeded, were sown. Bluegrass holds for a time and then the native wild grasses and broom sedge gradually take possession of the land. To reestablish bluegrass it is necessary to break the fields again, cultivate one or two crops, and then reseed. Commonly the bluegrass comes in naturally following the cultivated grasses that are cut for hay. The red soils occurring on the slopes are best suited to bluegrass, holding sod about as well as the limestone lands. In fact, these red shale beds are more or less calcareous. Very little care is given the pastures beyond the occasional cutting of the weeds and other growths, yet much of the land after long periods, in some cases of more than 50 years, is still producing good pasture, with no sign of deterioration.

Where the pasture sods do not hold well, their life should be prolonged by giving them top dressings of stable manure, or where this is not available applications of lime and phosphoric acid. Where they can be had cheaply, ground limestone and phosphatic rock (floats) may be employed to advantage.

Timothy, redtop, and clover are grown for hay and give good yields. The fields are then pastured, bluegrass coming in as the other grasses die out. Very few of the steeper hillsides are cultivated, but corn does well upon the slopes, especially on new or sod land. The yield ranges from 20 to 75 bushels an acre, without commercial fertilizers, and averages about 35 bushels. The higher yields are obtained on the more

level areas and the lower slopes. It is the practice now to take not more than two crops of corn before seeding down to small grains and grass. Wheat and oats also give fair yields.

Fertilizers are not used on this soil to any extent. They were tried some years ago, with unsatisfactory results, and their use was discontinued. There is a tendency now, however to revert to their use. There is apparently no reason why this soil should not respond to the use of lime and the phosphatic fertilizers.

Parts of the type will produce fruit, apples and peaches doing well. The upper slopes, in the covelike areas with north and east exposures, where the soil is more loamy and better moisture conditions prevail, are good locations for orchards.

The forest growth on the Meigs clay loam consists of oak, chestnut, maple, hickory, and poplar. The poplar was found most abundant on the northern and eastern exposures and gave to these locations the name "poplar land," while the south and west slopes are classed locally as "white oak land." The latter is not so highly valued as the former.

Farm lands of the Meigs clay loam range in price from \$10 to \$75 an acre, with the oil, gas and coal rights reserved. The general average is about \$35 an acre. The price has advanced somewhat in recent years.

#### **Dekalb Silt Loam.**

The surface soil of the Dekalb silt loam consists of a grayish-brown, smooth, friable to heavy silt loam, becoming pale-yellow in color below the first 3 or 4 inches. The subsoil, encountered at an average depth of 8 inches, consists of a yellow silt loam, usually grading into a silty clay loam and occasionally into a silty clay, somewhat plastic in structure. Where the underlying sandstone beds approach the surface the subsoil, in its upper section, differs very little in texture from the surface soil, but becomes more sandy as the bedrock is approached. The sand particles range from fine to very fine and give a gritty to sandy feel. Where typically developed the type is close and compact in structure, while in the sandy subsoil phase it is more open and friable.

As a rule the type is free from stone fragments, except where it grades into the stony types, such as are developed on the upper or lower slopes, in which case some shale and slabby pieces of sandstone are encountered. The depth of soil is usually more than 3 feet, but occasionally the underlying rock comes within 2 feet of the surface. The average depth is probably between 6 and 10 feet.

The Dekalb silt loam is found in small, irregular bodies scattered throughout areas of the other upland soils. The total area is relatively small. The areas occur on flat tops of hills and ridges and on flat benches or shelves (not stream terraces) on slopes, and have a flat to gently undulating surface. In places this soil extends down gentle slopes, but nowhere does it occur on steep slopes.

The type owes its position to the presence of massive beds of resistant sandstone that have withstood weathering. The soil material was derived from the overlying grayish shales and fine-grained sandstone, and probably also to some extent from the underlying massive sandstone beds.

The high position of the Dekalb silt loam insures good drainage, although the more level areas may need some ditches or tile drains to put them in the best possible condition.

The moisture-holding power of the type is low and as a whole it is inclined to be droughty, especially in areas where the bedrock approaches the surface. In only moderately dry spells crops often suffer from lack of moisture.

All of the type is cleared and under cultivation, being considered a desirable soil because of its smooth and even surface. Most of this land has been under cultivation for a long time and cropped rather exhaustively. It is only a moderately productive soil. The grasses do only fairly well and only light yields of hay are secured under ordinary conditions. Bluegrass does not thrive sufficiently to encourage the use of this soil for grazing. Small grains, with fertilizers, make good yields. Buckwheat does comparatively well and also Irish potatoes, the latter yielding from 50 to 100 bushels. These yields could be increased readily with better methods of culture. Corn gives only moderate crops.

This soil is deficient in organic matter and a system of soil management to supply this important soil constituent should be followed. Stable manure is one of the best fertilizers, adding plant food, supplying organic matter, and improving the tilth and moisture-holding capacity of the soil. The State Experiment Station has found by experiments conducted on this soil that increases in all crops were made with the use of manure, and that better results were secured with manure than with any other fertilizer. Where stable manure is not available green manuring crops, especially the legumes, such as clover and cowpeas, should be employed.

This soil is favorably located in most cases for orchard fruits, particularly apples.

The original native growth consisted of oak and chestnut.

The areas of this soil are so small that rarely is a farm composed entirely of this one type, and while it is not as strong as the soils on the slopes, farms which include some of this type are considered very desirable, particularly for the production of garden vegetables, potatoes and buckwheat. The value of the land varies according to location and accessibility. Ordinarily prices range from \$10 to \$50 an acre.

The following table shows the results of mechanical analyses of samples of the soil and subsoil of the Dekalb silt loam:

**Mechanical Analyses of Dekalb Silt Loam.**

| No     | Locality                         | Description                                   | Fine gravel,<br>3 to 1<br>mm | Coarse sand,<br>1 to 0.5<br>mm | Medium sand,<br>0.5 to 0.25<br>mm | Fine sand,<br>0.25 to 0.1<br>mm | Very fine sand,<br>0.1 to 0.05<br>mm | Silt,<br>0.05 to 0.005<br>mm | Clay,<br>0.005 to 0<br>mm |
|--------|----------------------------------|---|------------------------------|--------------------------------|-----------------------------------|---------------------------------|--------------------------------------|------------------------------|---------------------------|
|        |                                  |   | P. ct.                       | P. ct.                         | P. ct.                            | P. ct.                          | P. ct.                               | P. ct.                       | P. ct.                    |
| 220801 | 1 mile northeast of Meadland.    | Brown silt loam, 0 to 6 inches.               | 0.8                          | 1.1                            | 0.9                               | 2.7                             | 3.6                                  | 70.7                         | 20.5                      |
| 220802 | Subsoil of 220801.               | Silt loam to silty clay loam, 6 to 36 inches. | .0                           | 1.0                            | 1.0                               | 2.0                             | 3.7                                  | 68.7                         | 25.7                      |
| 220825 | 1 mile north of Morgantown.      | Brown silt loam, 0 to 9 inches.               | 1.2                          | 2.2                            | 1.1                               | 2.1                             | 6.7                                  | 65.2                         | 21.6                      |
| 220826 | Subsoil of 220825.               | Silt loam to silty clay loam, 9 to 36 inches. | .5                           | 1.6                            | 1.0                               | 1.7                             | 5.5                                  | 60.6                         | 28.8                      |
| 220833 | 1½ miles south east of Fairmont. | Brown silt loam, 0 to 8 inches.               | .4                           | 1.9                            | 2.5                               | 5.5                             | 4.0                                  | 62.6                         | 22.8                      |
| 220834 | Subsoil of 220833.               | Silt loam to silty clay loam, 8 to 36 inches. | .8                           | 1.0                            | 1.5                               | 3.6                             | 4.6                                  | 58.3                         | 32.1                      |



### Dekalb Silty Clay Loam.

The surface soil of the Dekalb silty clay loam to a depth of 5 to 8 inches consists of a grayish-brown to yellowish-brown silty clay loam, the surface few inches being generally decidedly silty and in places, such as the lower slopes or on rather flat areas, a heavy silt loam. Some patches are considerably heavier than the typical soil, approaching the texture of a silty clay. The soil is usually rather friable and mellow and easily worked. In places both soil and subsoil are quite gritty. The subsoil is a yellow silty clay loam to silty clay, generally friable or brittle and in places becoming quite plastic. Occasionally the lower subsoil is somewhat mottled with various shades of gray and brown, such coloring being due often to the presence of partially decomposed shale fragments. Sometimes the subsoil has a slight reddish cast. Upon the surface and throughout the soil mass fragments of shale and sandstone, the former partially weathered, are frequently encountered, but not in quantities sufficient to interfere with cultivation. The more stony areas are confined to the steep slopes, where the sandstone ledges are not deeply covered with soil material, while on the smoother slopes, where the shales seem to have predominated, the harder rock is lacking or is represented only by narrow bands of sandy shale or shaly sandstone fragments. A variation not common in this type occurs in central Taylor County and at a few places in Monongalia County, where bands of red soil are encountered on the hill slopes. While these are distinct, they are too small to map separately and have necessarily been included with the type. This phase approaches the condition of the Meigs clay loam, characterized by its patches of red soil, but in the latter there are usually a number of bands or streaks which have influenced the surrounding soils by intermingling with them.

The Dekalb silty clay loam is one of the most extensive soil types in the survey, occurring in all three counties. West of the Monongahela in Marion and Monongalia counties it forms an irregular belt between the Meigs clay loam and the Westmoreland silty clay loam. It occupies the eastern half

of Taylor County, and is well developed in eastern Marion and Monongalia Counties.

The topography is hilly, the soil occurring on the slopes and on the ridge and hilltops as well. West of the Monongahela the Dekalb silty clay loam grades into the Meigs clay loam on the lower slopes of the hills, which are usually gentle and smooth. Generally to the east the formation rises, covering the whole slope and tops of the hills, and the type merges into the Westmoreland silty clay loam on the tops of the high ridges. In this belt the slopes are smooth and steep, although there are sections where the Dekalb silty clay loam covers both the tops and slopes of ridges, and the topography, though hilly, is not quite so broken and is better suited for cultivation. In the eastern parts of the area it covers the highest hills from base to summit. The slopes are generally steep, though the ridge tops are often rounded and quite broad. As would be expected from its hilly topography, the type has good surface drainage. The presence of stone throughout the soil mass in most cases further permits some downward movement of water. Seepy places are common on the slopes.

This soil is readily affected by drought, and crops suffer, but not to the extent they do on limestone lands.

The Dekalb silty clay loam is of residual origin and is derived from interbedded shales and sandstones. There are also some limestone beds, but these are thin and have very little effect, if any, upon the soils. The soil material comes from the Upper Monongahela, Lower Dunkard, Conemaugh, and Allegheny formations. The weathering of these rocks is not complete, as their fragments are found upon the surface and in the soil mass. Generally the depth of soil material exceeds 3 feet, but in places ledges approach the surface or outcrop.

This soil generally is friable and mellow and readily works into a good condition of tilth. The steep hillsides are difficult to cultivate and where worked are subject to damage by washing.

The greater part of the Dekalb silty clay loam is cleared and devoted to cultivated crops and to grass. Like all the up-

lands,, the larger part is in grass, but as a whole it is not as strong grass land as the Meigs clay loam or Westmoreland silty clay loam. It does not seed naturally with bluegrass nor hold a bluegrass sod as do the two last-mentioned soils. Bluegrass persists for a while, but soon gives place to the native wild grasses. Broom sedge soon takes possession of most of the old fields.

Timothy and redtop are the principal grasses sown. They give moderate yields of hay. Clover is also sown to some extent, and where the soil is limed succeeds. Corn gives fair average yields and so do wheat and oats. Buckwheat does well on this soil, especially in the eastern section of the area, from 10 to 20 bushels per acre being secured. Irish potatoes do fairly well. Apples, while not grown on a commercial scale, are grown to some extent, and apparently give satisfactory results. Where the location is favorable, this soil should prove suited to commercial apple and peach orchards.

Commercial fertilizers are used on all crops on the Dekalb silty clay loam. The land is generally considered thin and the use of fertilizers necessary. The quantities used are small, and the fertilizer is generally of low grade. From 100 to 200 pounds to the acre are used. Barnyard manure gives better results than fertilizers. Quite a numbers of farmers apply lime and, as a rule, find it beneficial. The greatest need of this soil is the incorporation of organic matter to improve its moisture-holding capacity and to add humus and nitrogen. When barnyard manure can not be had green manuring crops should be turned under, preferably legumes, such as clover or cowpeas. Winter cover crops like rye and barley should be used when the land is cultivated, and plowed under in the spring to furnish organic matter.

The pastures should be reseeded often and treated with applications of fertilizers. Finely ground limestone and floats (phosphate rock) would help to improve the stand of grass even where the sod is not broken. The native forest growth consists mainly of oak and chestnut.

The value of the farms of this type of soil ranges from \$10 to \$50 an acre.

The following table shows the results of mechanical analyses of samples of the soil and subsoil of the Dekalb silty clay loam:

Mechanical analyses of Dekalb silty clay loam.

| No     | Locality                                      | Description                                    | Fine gravel, | Coarse sand, | Medium sand,   | Fine sand,     | Very fine sand, | Silt,            | Clay,          |
|--------|---|--|--------------|--------------|----------------|----------------|-----------------|------------------|----------------|
|        |   |  | 2 to 1 mm    | 1 to 0.5 mm  | 0.5 to 0.25 mm | 0.25 to 0.1 mm | 0.1 to 0.05 mm  | 0.05 to 0.005 mm | 0.005 to 0 mm. |
|        |   |  | P. ct.       | P. ct.       | P. ct.         | P. ct.         | P. ct.          | P. ct.           | P. ct.         |
| 220805 | 2 miles north-west of Grafton.                | Brown silty clay loam, 0 to 7 inches.          | 1.4          | 3.0          | 1.2            | 2.1            | 4.0             | 53.1             | 34.4           |
| 220806 | Subsoil of 220805.                            | Yellow silty clay, 7 to 36 inches.             | 1.4          | 2.3          | 1.7            | 2.9            | 4.1             | 51.7             | 36.0           |
| 220809 | One and one-half miles southeast of Opekiaka. | Brown silty clay loam, 0 to 6 inches.          | 1.8          | 1.6          | .9             | 2.2            | 4.4             | 58.0             | 31.1           |
| 220810 | Subsoil of 220809.                            | Silty clay loam to silty clay, 6 to 36 inches. | 1.8          | 3.2          | 2.0            | 3.7            | 5.1             | 56.1             | 28.6           |
| 220831 | One-half mile west of Fairmont.               | Brown silty clay loam, 0 to 8 inches.          | 2.8          | 5.8          | 4.6            | 6.1            | 8.3             | 50.8             | 21.5           |
| 220832 | Subsoil of 220831.                            | Silty clay loam to silty clay, 8 to 36 inches. | 1.8          | 2.5          | 1.8            | 3.1            | 7.6             | 47.8             | 35.4           |

### Dekalb Stony Loam.

The Dekalb stony loam, as typically developed, consists to a depth of 5 to 8 inches of a light or grayish-brown silty loam to silty clay loam, friable and mellow. The subsoil is a uniform yellow silt loam to silty clay, containing a sufficient content of sand to make it friable, and extending to a depth of 3 feet or more. Areas of light medium sandy loam too small to be shown on a map of the scale used in this survey are frequently found included in the type. The subsoil is occasionally tinged with red and in places the underlying sandstone bedrock closely approaches the surface.

Sandstone and shale fragments are found upon the surface and throughout the soil mass, usually in quantities sufficient to be conspicuous and to interfere more or less with cultivation. The soil itself is easily tilled, aside from the inconvenience resulting from these rock fragments. Physically the soil is typical of the established type, except that there are

on the average not so many stone fragments as in most other areas.

The Dekalb stony loam is quite extensively developed in eastern Monongalia County, where it occurs in comparatively large but irregular-shaped areas. A few small tracts are found in eastern Marion and Taylor Counties. The type is principally developed on slopes. In places it extends over the top of Chestnut Ridge. The slopes, as a rule, are long and smooth, and while rather steep are not so pronounced as the slopes of the hills of the other upland soil types. The tops where it occurs are broad and domelike. The type merges into the Rough stony land areas and to the south and west into the Dekalb silty clay loam. The small areas in Taylor and Marion Counties are found in the bowl-like depressions where streams head, the development of these stony areas being due to the presence of the talus from sandstone ledges near the tops of the ridges.

The sloping surface of the type admits of ready surface drainage and the presence of stone in the soil mass allows free downward percolation of water, so that fairly good conditions of moisture are maintained at all times, and except in places where the soil is shallow it is not subject to drought.

The Dekalb stony loam is of residual origin and is derived from interbedded shales and sandstones belonging to the Lower Conemaugh and Allegheny formations. A number of sandstone strata occur in the formations contributing to the soil material and where these are present broken rock is found on the surface and throughout the soil mass. The Homewood sandstone of the Pottsville also enters to some extent into the formation of this soil type.

The greater part of the soil is cleared and under cultivation. Although it is not considered a strong soil, fair crops are generally assured in most seasons, as it is not affected so severely by extremes of moisture. The type averages somewhat higher as an agricultural soil in this area than in other sections of the state so far surveyed. Commercial fertilizers are used with the different crops, applications ranging from 100 to 200 pounds per acre. Corn yields from 15 to 50 bushels or more to the acre. The small grains make rather low yields.

Buckwheat, however, does especially well and is grown on almost every farm. Yields of this grain range from 10 to 35 bushels an acre, with 15 to 20 bushels a fair average. Potatoes and garden vegetables do well on this soil. Grass holds only fairly well and the hay yield is below the average. Timothy and redbtop are sown with some clover and the pastures later run to native wild grasses, except bluegrass, which does not spread naturally on this soil. In favorable locations this soil should be well adapted to fruit growing. Apples, peaches, and plums would undoubtedly prove profitable.

The native tree growth is composed largely of oak and chestnut. The value of land composed of this type of soil ranges from \$20 to \$25 an acre, according to location and improvements.

The following table shows the results of mechanical analyses of samples of the soil and subsoil of this type:

Mechanical Analyses of Dekalb Stony Loam.

| No.    | Locality.                        | Description.                           | Fine gravel,<br>2 to 1<br>mm. |        | Coarse sand,<br>1 to 0.5<br>mm. |        | Medium sand,<br>0.5 to<br>0.25<br>mm. |        | Fine sand,<br>0.25 to<br>0.1<br>mm. |        | Very fine sand,<br>0.1 to<br>0.005<br>mm. |        | Silt,<br>0.05 to<br>0.005<br>mm. |  | Clay,<br>0.005<br>to 0<br>mm. |  |
|--------|----------------------------------|--|-------------------------------|--------|---------------------------------|--------|---------------------------------------|--------|-------------------------------------|--------|---|--------|----------------------------------|--|-------------------------------|--|
|        |                                  |  | P. ct.                        | P. ct. | P. ct.                          | P. ct. | P. ct.                                | P. ct. | P. ct.                              | P. ct. | P. ct.                                    | P. ct. |                                  |  |                               |  |
| 220829 | 6 miles southeast of Morgantown. | Brown stony silty loam, 0 to 6 inches. | 1.1                           | 1.9    | 1.8                             | 5.0    | 7.5                                   | 55.7   | 26.9                                |        |   |        |                                  |  |                               |  |
| 220830 | Subsoil of 220829.               | Silty clay loam, 6 to 30 inches.       | .7                            | 2.2    | 1.8                             | 4.4    | 7.8                                   | 55.8   | 27.8                                |        |   |        |                                  |  |                               |  |

#### Westmoreland Silty Clay Loam.

The Westmoreland silty clay loam consists of 4 to 10 inches of a grayish to light-brown silty clay loam, grading into a yellowish brown with depth. The surface few inches are decidedly silty. The subsoil consists of a yellowish to brownish-yellow silty clay loam, grading quickly into a silty clay, the latter being generally somewhat plastic. On the gentle lower slopes and more level situations the texture at times approaches a silt loam. The color of this soil is frequently a dark chocolate brown, though over the limestone strata from which

this soil is in part derived the surface soil is a gray to yellowish heavy clay loam to clay, underlain by a stiff, plastic, yellow clay, occasionally mottled with gray or olive green. The depth generally exceeds 36 inches, except where the underlying rock approaches more closely to the surface.

The Westmoreland silty clay loam constitutes what is known locally as "limestone land," and is found in all three of the counties embraced in this survey. It is not derived from limestone exclusively, but rather from interbedded limestone and shales—some of which are calcareous—and some sandstone, the last-named being inconspicuous. The soil material derived from these rocks has intermingled in many places in such a way as to give rise to a fairly uniform soil type, although some patches of Dekalb silty clay loam and some spots of pure limestone soil have been included. Weathering has been complete, and, except on the tops of hills and ridges, the areas are for the most part free of rock fragments.

These pure limestone soil areas are confined to small spots on slopes over limestone ledges, or where the limestone strata are present near the surface. Had they been more extensive, they would have been separated and mapped as a separate type, Brooke clay loam, locally known as "ridge limestone land."

The rocks giving the Westmoreland silty clay loam belong to the Monongahela and Conemaugh formations. The upper limit in the Monongahela is the Uniontown limestone, which is about 270 feet above the Pittsburgh coal. Between the limestone and the coal are several important limestone formations. Below the Pittsburgh coal the limestones, as a rule, are not so prominent, but occur in several beds, mostly thin and unimportant. The lower limit is usually the Clarksburg limestone, 165 feet below the Pittsburgh coal, but in places the limestone soil extended to the Buffalo sandstone in the lower Conemaugh. East of the Monongahela in Marion and Monongalia the limestones were not persistent, being supplanted by sandstones, so that in places no limestone soils were found associated below or immediately above the Pittsburgh coal.

The Westmoreland silty clay loam is found throughout the area. In Marion and Monongalia Counties it follows the course of the Monongahela River and in Taylor County it occurs in the western part along the Harrison County line, broadening out to the south along the Barbour County border. Like the other main upland soil types, it occupies hilly topography, although usually somewhat smoother than the average. The hill or ridge tops are generally rounded, with long, smooth slopes. Occasionally the slopes are broken by benches formed by the more resistant beds of limestones. Such spots are marked by the stronger growth and by the bright green color of the grass. The surface configuration provides ready surface drainage. The type suffers from erosion, gullies being found where care is not taken to check the rapid run-off of storm waters. Small, bare, eroded spots on the hill slopes are very common.

The calcareous nature of the Westmoreland silty clay loam makes it an especially desirable soil for bluegrass, consequently it is more profitable for grazing purposes than for the production of cultivated crops. Bluegrass takes possession of the land naturally and the sod is practically permanent. From 3 to 5 acres is enough to support a 3-year-old steer. Whenever the fields are cultivated and are returned to grass timothy, redbud, and clover are sown. Sometimes orchard grass is substituted. These are cut for hay for a number of seasons and in the meantime bluegrass comes in and finally the field is turned over to permanent pasture. The yield of hay is the highest secured on any of the upland soils. Orchard grass does well, especially on the lower slopes or where moist conditions prevail. Very little of this soil is devoted to cultivated crops, but such areas give good yields. Corn ranges from 35 to 75 bushels to the acre and the small grains yield correspondingly well. The crops are grown without fertilizers, though some farmers are beginning to make small applications. Lime is used by some and is always followed by beneficial results.

Practically all the land of this type is cleared. The original growth consisted of the deciduous hardwoods. The locust



is partial to this soil and is seen in small groves on the hill-sides and along the fence rows. The growing of this tree for fence posts would no doubt prove a profitable venture. Farms on this soil have a generally prosperous appearance, the houses and outbuildings being large and in good repair. Large barns are quite common, which is not the rule for the area as a whole.

The land, aside from the valuable coal beds underlying most of it, has a high value. It is not on the market, but is held at prices ranging from \$50 to \$100 an acre.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Westmoreland silty clay loam:

Mechanical Analyses of Westmoreland Silty Clay Loam.

| No     | Locality                     | Description                                    | Fine gravel, | Coarse sand,   | Medium sand,   | Fine sand,     | Very fine sand,  | Silt,         | Clay   |
|--------|------------------------------|--|--------------|----------------|----------------|----------------|------------------|---------------|--------|
|        |                              |  | 2 to 1 mm    | 0.5 to 0.25 mm | 0.25 to 0.1 mm | 0.1 to 0.05 mm | 0.05 to 0.005 mm | 0.005 to 0 mm |        |
|        |                              |  | P. ct.       | P. ct.         | P. ct.         | P. ct.         | P. ct.           | P. ct.        | P. ct. |
| 220807 | 1½ miles north of Simpson.   | Silty clay loam, 0 to 7 inches.                | 1.0          | 1.8            | 1.8            | 3.1            | 3.4              | 43.2          | 46.3   |
| 220808 | Subsoil of 220807.           | Yellow silty clay, 7 to 36 inches.             | .4           | .9             | 1.1            | 2.2            | 1.0              | 41.0          | 53.8   |
| 220811 | 5 miles south of Fairmont.   | Silty clay loam, 0 to 7 inches.                | 1.8          | 1.3            | 1.0            | 1.9            | 3.7              | 59.7          | 31.0   |
| 220812 | Subsoil of 220811.           | Yellow silty clay, 7 to 36 inches.             | .8           | 1.8            | 1.4            | 3.0            | 2.9              | 47.4          | 42.9   |
| 220821 | 1 mile north of Vanvoorthia. | Silty clay loam, 0 to 8 inches.                | .8           | 1.2            | .8             | 1.5            | 3.7              | 65.6          | 26.4   |
| 220822 | Subsoil of 220821.           | Silty clay loam to silty clay, 8 to 36 inches. | .4           | 1.2            | .9             | 1.5            | 4.9              | 60.6          | 30.3   |

### Rough Stony Land.

Rough stony land includes areas too steep and stony to cultivate and naturally unsuited to agriculture. It is limited to the steep hillsides and mountainous areas. The type owes its existence to massive beds of sandstone which outcrop usually near the tops of hillsides, forming precipitous cliffs below which the talus gives rise to exceedingly stony slopes, broken by large boulders, and unsuited to cultivation. These occurrences are found along the streams and are indicated on

the map by appropriate symbols. In northeastern Monongalia County Rough stony land is frequently found on the broad, smooth tops of the ridges, together with rock outcrops, remains of former rock beds and large angular boulders, some of them the size of a small house.

Areas of Rough stony land are scattered throughout the three counties, but occur more frequently and in larger areas in the eastern sections, where the sandstone formations are more in evidence. The smaller areas are found along abrupt slopes to streams and the larger along the Monongalia and Preston County line. The Cheat River and Deckers Creek gorges are so steep and stony that they are almost impassable. The type is found in all of the geological formations outcropping in the county, including the Upper and Lower Carboniferous. The Allegheny and Pottsville series are most prominent in its formation, as they are largely composed of massive strata of sandstone. The Pottsville forms the top and upper slopes of the mountainous ridge in northeast Monongalia, while the strata below are found in the Cheat River and Deckers Creek gorges.

The term Rough stony land as used in the soil classification denotes a condition rather than a soil type. Except upon the bare rock outcroppings, some soil is found between the stones and boulders and is of variable texture, but similar to that occurring on the same slope where agriculture can be carried on.

Rough stony land areas support a growth of oak, chestnut, and various other trees and shrubs. In the gorges and steep ravines in the eastern part of the area the mountain laurel and hemlock are characteristic of the type. This class of land should be allowed to remain forested. Cleared areas, which are few, are used as permanent pastures. Aside from its forest growth and its slight value as pasture, the Rough stony land is practically worthless.

#### **Elk Silt Loam.**

The Elk silt loam consists of 6 to 10 inches of light-brown to yellowish-brown silt loam, generally friable and mellow,

underlain ordinarily by a yellow, friable silt loam to silty clay loam, becoming more sandy at depths ranging from 24 to 30 inches. In some situations, such as next to upland slopes, where the material may be in part residual or alluvial, the subsoil is somewhat heavier, changing from a silty clay loam to silty clay of a slightly plastic structure. The material as a rule is friable, but becomes quite sticky when wet. Another variation is found near Fairmont, where the soil is slightly sandy in small spots and underlain by beds of bright yellow to reddish-yellow sand. These deposits have been opened and the sand used for building purposes.

The type is generally free from stone and gravel, though occasionally where shale ledges come near the surface there are some fragments of this rock in the soil mass. In other places also, as shown by exposures on sides of ravines, the soil mantle overlies either sandstone or limestone beds, but these are usually more than 3 feet beneath the surface. As a whole the depth of the soil formation is several feet.

The Elk silt loam is the most extensive of the transported soils. It is confined principally to the Monongahela River Valley, although some areas are found along the tributary streams near their confluence with the Monongahela. The largest areas are in the bends of the river and in the vicinity of Fairmont, where the Tygart and West Fork Rivers come together. The areas are not continuous, occurring on each side of the stream as the channel meanders from side to side.

The Elk silt loam is a stream terrace soil. Although the surface was originally flat, much of the type has been dissected in varying degrees by erosion, some areas being now gently rolling. The terraces drop off to the first bottoms, either through slopes or by sharp bluffs. The elevation of the terraces above the stream channels ranges from 40 to 150 feet.

The Elk silt loam is derived from old alluvium deposited when the water of the streams reached higher levels.

The type is probably composed of material derived from all the soils of the drainage basin, including considerable limestone soil. It differs in this from the Holston silt loam, which has its origin mainly from wash from shale and sandstone

soils. In places some of the lower subsoil may be residual from the underlying rocks. Near the upland slopes the soil has been influenced to some extent by colluvial material from the adjacent slopes.

Lying as it does, on terraces well above the river, the drainage is well established. The structure is friable and mellow, and the soil, therefore, easy to cultivate. Its proximity to a large stream and the favorable surface configuration caused it to be one of the first to be brought under cultivation. It is practically all occupied at the present time, all the crops of the region being produced upon it, though, as with most soils of this area, a large part is in grass for hay or pasturage. Bluegrass occurs to some extent upon it, but timothy, redbud, and clover are the crops cut for hay, with occasionally some orchard grass. The yield of hay is fair, and the pastures are fairly durable. The small grains, and especially wheat, do well on this soil. Corn is the most important of the cultivated crops, giving fair to good yields. Although only small patches of potatoes are grown, the yields are excellent, and the acreage could profitably be increased. Very little trucking is done in the area. This soil is better than any of the other types for this purpose. It would be adapted to a wide range of vegetable crops, and could support an extensive trucking industry. It would also prove suitable for small fruits, strawberries, and other berries.

This soil responds readily to any good system of management. Its greatest need is the incorporation of organic matter, in which it is now deficient. Barnyard manure is the best for this purpose, but lacking this, the legumes, such as clover, cowpeas, soy beans, and vetches, plowed under, are very satisfactory.

The following table shows the results of mechanical analyses of samples of the soil and subsoil of the Elk silt loam:

## Mechanical Analyses of Elk Silt Loam.

| No.    | Locality.                     | Description.                                  | Fine gravel,<br>2 to 1<br>mm. |        | Coarse sand,<br>1 to 0.5<br>mm. |        | Medium sand,<br>0.5 to<br>0.25<br>mm. |        | Fine sand,<br>0.25 to<br>0.1<br>mm. |        | Very fine sand,<br>0.1 to<br>0.05<br>mm. |        | Silt,<br>0.05 to<br>0.005<br>mm. |  | Clay<br>0.005<br>to 0<br>mm |  |
|--------|-------------------------------|---|-------------------------------|--------|---------------------------------|--------|---------------------------------------|--------|-------------------------------------|--------|--|--------|----------------------------------|--|-----------------------------|--|
|        |                               |   | P. ct.                        | P. ct. | P. ct.                          | P. ct. | P. ct.                                | P. ct. | P. ct.                              | P. ct. | P. ct.                                   | P. ct. |                                  |  |                             |  |
| 220819 | 2 miles north of Morgantown.  | Brown silt loam, 0 to 8 inches.               | 0.4                           | 0.9    | 1.0                             | 2.1    | 5.4                                   | 72.8   | 17.2                                |        |  |        |                                  |  |                             |  |
| 220820 | Subsoil of 220819.            | Yellow silt loam, 8 to 36 inches.             | .0                            | .3     | .4                              | 1.0    | 3.4                                   | 68.5   | 26.2                                |        |  |        |                                  |  |                             |  |
| 220835 | 1 mile southwest of Fairmont. | Brown silt loam, 0 to 8 inches.               | .7                            | 2.0    | 1.7                             | 3.3    | 9.7                                   | 63.9   | 18.6                                |        |  |        |                                  |  |                             |  |
| 220836 | Subsoil of 220835.            | Silt loam to silty clay loam, 8 to 36 inches. | 1.1                           | 2.2    | 2.0                             | 4.2    | 9.1                                   | 62.0   | 19.2                                |        |  |        |                                  |  |                             |  |

## Holston Silt Loam.

The surface soil of the Holston silt loam to a depth of 6 to 10 inches consists of a light to yellowish-brown, friable silt loam. This is underlain by yellow silt loam, usually changing to light silty clay loam, and frequently to silty clay, although in places the subsoil continues downward as a friable silt loam, becoming a little lighter textured or sandy in the lower portions and somewhat compact at depths below 24 inches. In the lower-lying, poorly-drained areas some mottling of gray is found in the subsoil, such areas approaching the characteristics of the Tyler silt loam. The areas along Cheat and Tygart Rivers carry more sand particles, and in places approach a sandy loam texture.

The Holston silt loam is generally free of stone or gravel, except in the areas along Cheat River, where small, rounded gravel and sandstone cobbles are found in the soil mass and on the surface. Small deposits of sand are also encountered.

The type is most extensively developed along Dunkard Creek, in the northern part of Monongalia County, along the Cheat and Tygart Rivers, in Marion and Taylor Counties, and in small areas along the larger creeks. It is found as terraces varying in altitude from 40 to 150 feet above the present levels of the streams. These originally flat terraces have been dissected somewhat by erosion, and are now more or

less gently rolling. Only in a few places has the original flat surface been preserved.

The type owes its origin to water-deposited materials laid down when the streams flowed at higher levels than now. The material was deposited in the same way as that of the Elk silt loam, which type it resembles very closely. It differs from the Elk in that it was washed from regions containing very little limestone soil, being largely derived from shale and sandstone soils.

The Holston silt loam is a type of moderate productivity. It is a well-drained soil, and produces the general crops of this region. It is easily worked, responds readily to good treatment, and is all cleared and devoted to farm crops, a good part of it being in grass for either hay or pasturage. It gives fair yields, especially of corn and potatoes, but is not a strong grass land. It could be advantageously used for small fruits and truck crops.

The greatest need of the type is organic matter. This may be supplied either as stable manure or by turning under green manuring crops. The value of farming lands of this type is high.

The following table shows the results of mechanical analyses of samples of the soil and subsoil of this type:

**Mechanical Analyses of Holston Silt Loam.**

| No.    | Locality.                          | Description.                                  | Fine gravel, | Coarse sand,    | Medium sand,    | Fine sand,      | Vary fine sand, | Silt,             | Clay           |
|--------|------------------------------------|---|--------------|-----------------|-----------------|-----------------|-----------------|-------------------|----------------|
|        |                                    |   | 2 to 1 mm.   | 0.5 to 0.25 mm. | 0.5 to 0.25 mm. | 0.25 to 0.1 mm. | 0.1 to 0.05 mm. | 0.05 to 0.005 mm. | 0.005 to 0 mm. |
| 220813 | 6 miles south of Fairmont.         | Brown silt loam, 0 to 8 inches.               | P. ct. 0.3   | P. ct. 1.9      | P. ct. 3.4      | P. ct. 10.1     | P. ct. 8.4      | P. ct. 57.4       | P. ct. 18.5    |
| 220814 | Subsoil of 220813.                 | Silt loam to silty clay loam, 8 to 36 inches. | .0           | 1.3             | 2.6             | 10.0            | 11.1            | 51.9              | 22.6           |
| 220817 | 1½ miles northeast of Mooresville. | Brown silt loam, 0 to 8 inches.               | .5           | .9              | .7              | 4.5             | 6.1             | 67.1              | 20.0           |
| 220818 | Subsoil of 220817.                 | Yellow silt loam, 8 to 36 inches.             | .3           | 1.0             | .9              | 6.1             | 8.2             | 62.9              | 20.5           |

### Tyler Silt Loam.

The Tyler silt loam consists of 8 inches gray to grayish-brown, slightly friable silt loam, underlain to a depth of 24 inches by a pale-yellow to yellow silty clay loam, grading into a silty clay in the lower portion. At 18 to 20 inches mottlings of gray, yellow, drab, and brown appear, the gray becoming more pronounced with depth. The type is free from stone and gravel.

There are only a few small areas of the Tyler silt loam in the area. These occur on Dunkard Creek and to a less extent along several other streams. All the type mapped is found in western Monongalia County, although areas too small to map are encountered in other sections. The type occupies flat to gently sloping terraces along streams and is closely associated with the Holston silt loam. It is derived from the same material as the Holston silt loam, the difference being the result of poor drainage. The average elevation of the type above the stream courses is 40 feet. Its close, compact subsoil is more or less impervious and the areas are generally wet and cold.

Owing to its poorly drained condition the type is best adapted to grass. When drained it gives good crops of the small grains. In moderately dry seasons corn does fairly well, but in wet seasons the crops drown, the impervious subsoil holding the water on the surface.

The extent of this soil is so small that it is of very little importance in this area. With drainage and careful management it can be made a productive type.

The following table shows the results of mechanical analyses of samples of the soil and subsoil of this type:

Mechanical Analyses of Tyler Silt Loam.

| No.    | Locality.              | Description.                                   | Fine gravel,<br>2 to 1<br>mm. | Coarse sand,<br>1 to 0.5<br>mm. | Medium sand,<br>0.5 to<br>0.25<br>mm. | Fine sand,<br>.25 to<br>0.1<br>mm. | Very fine sand,<br>0.1 to<br>0.05<br>mm. | Silt,<br>0.05 to<br>0.005<br>mm. | Clay<br>0.005<br>to 0<br>mm |
|--------|------------------------|--|-------------------------------|---------------------------------|---------------------------------------|------------------------------------|--|----------------------------------|-----------------------------|
|        |                        |  | P. ct.                        | P. ct.                          | P. ct.                                | P. ct.                             | P. ct.                                   | P. ct.                           | P. ct.                      |
| 220803 | 3 miles north of Core. | Brown silt loam, 0 to 8 inches.                | 0.2                           | 0.9                             | 1.6                                   | 9.3                                | 7.6                                      | 60.6                             | 19.7                        |
| 220804 | Subsoil of 220803.     | Silty clay loam to silty clay, 8 to 36 inches. | .0                            | .3                              | 1.1                                   | 7.1                                | 6.4                                      | 47.1                             | 37.9                        |

### Huntington Silt Loam.

The surface soil of the Huntington silt loam, to an average depth of 10 inches, consists of a brown to chocolate-brown, friable silt loam to silty clay loam. The subsoil is usually lighter colored than the surface soil, owing to a lower organic matter content. It ranges from a light-brown to yellowish-brown or dark-yellow silt loam to silty clay loam, becoming slightly compact at depths below 24 inches and from 24 to 30 inches approaching somewhat a sandy loam in texture. Occasionally a gravelly substratum may be encountered within 36 inches of the surface.

In the eastern part of the area, where the sandstones occur in abundance, the texture in places is a medium to fine sandy loam on the surface, and this material is underlain by sandy loam to a depth greater than 36 inches. Usually, however, there is a silty mantle of varying depth overlying the sandy material. These areas frequently carry some gravel. Along the immediate banks of the streams the material is decidedly sandy. The sandy phases of the type are small and disconnected and but for their small size would have been recognized as a sandy type in the Huntington series. In the main the type is free of gravel or stone fragments on the surface, the exception being near the steep upland slopes where streams break through. The gravel is mostly shale and small pieces of shaly sandstone, with rounded or subangular edges.

The Huntington silt loam is widely distributed outside the territory occupied by the Moshannon silt loam. It occurs as narrow strips in the stream valleys; and while the areas are fairly numerous, the total extent is small. It is found occupying first bottoms along the streams, usually narrow and flat, or gently sloping to the upland levels. As mapped it occurs from barely above the stream level on the smaller branches and runs to as high as the 20-foot contour line along the larger creeks and rivers.

This type is of alluvial origin and is still in process of formation. The material is composed of sediments washed from the upland soils and deposited by the streams on their



flood plains in times of high water. The material comes from many different geological formations, including sandstone, shale, and limestone. The type has been considerably influenced by wash from the Westmoreland silty clay loam, the limestone soil of the area. The type is a fairly well drained soil, though in places small areas could be improved by open ditches. It ranks as a strong, productive soil.

This type is all cleared and under cultivation. A large part of it is in grass. Good yields of hay are secured and the moisture conditions being favorable, the growth of grass is excellent throughout the grazing season. Timothy and clover are the main hay crops. Orchard grass is also sown to some extent and makes a rank, heavy growth, being naturally adapted to a moist soil.

As in most bottom-land types, the small grains make a vigorous growth, but are subject to damage by freshets and have a tendency to lodge.

Corn is the leading cultivated crop on the type. It is particularly well adapted to this crop, and gives yields as high as 100 bushels or more per acre. Corn often receives all the manure made on the farms, as where it occurs the Huntington silt loam is relied upon to produce most of the corn for the farm needs.

In the eastern part of the area, where the sandy subsoil lying close to sandstone is encountered, this type is not considered so good, although it produces fair yields. The higher, well-drained parts produce fair crops of potatoes of good quality.

As most farms are cut by stream valleys, they usually include some bottom land, and the Huntington silt loam is therefore a considerable factor in determining farm values. As the bottom lands are not sold separately, their value can not be stated, although they increase the value of farm holdings according to their extent on individual farms.

The original forest growth consisted of sugar maple, oak, poplar, sycamore, walnut, and butternut.

The following table shows the results of mechanical

analyses of samples of the soil and subsoil of the Huntington silt loam:

**Mechanical Analyses of Huntington Silt Loam.**

| No     | Locality                                | Description                       | Fine gravel, | Coarse sand, | Medium sand,   | Fine sand,     | Very fine sand, | Silt,            | Clay          |
|--------|---|-----------------------------------|--------------|--------------|----------------|----------------|-----------------|------------------|---------------|
|        |   |                                   | 2 to 1 mm    | 1 to 0.5 mm  | 0.5 to 0.25 mm | 0.25 to 0.1 mm | 0.1 to 0.05 mm  | 0.05 to 0.005 mm | 0.005 to 0 mm |
|        |   |                                   | P. ct.       | P. ct.       | P. ct.         | P. ct.         | P. ct.          | P. ct.           | P. ct.        |
| 220815 | 2 miles northwest of Laurel Point.      | Brown silt loam, 0 to 12 inches.  | 0.4          | 1.0          | 1.1            | 4.4            | 7.9             | 54.7             | 30.5          |
| 220813 | Subsoil of 220815.                      | Brown silt loam, 12 to 36 inches. | .8           | 1.3          | 1.6            | 9.0            | 10.9            | 51.0             | 25.9          |
| 220827 | One-half mile northwest of Boothsville. | Brown silt loam, 0 to 10 inches.  | .1           | .6           | 1.8            | 14.0           | 17.5            | 39.8             | 26.0          |
| 220828 | Subsoil of 220827.                      | Silt loam, 10 to 36 inches.       | .0           | .5           | 1.9            | 15.0           | 13.5            | 44.9             | 23.7          |

**Moshannon Silt Loam.**

The surface soil of the Moshannon silt loam, to an average depth of 10 inches, consists of a dark-brown or dull reddish brown, mellow silt loam to silty clay loam. The subsoil is similar in texture to the soil, but is slightly compact, and at 24 to 30 inches usually becomes somewhat sandy. In color it is a yellowish brown, with a tinge of red. Typical areas of this soil found in the counties west of the area have an Indian-red to reddish-brown soil.

A variation from the type is noticed in the presence of a gravelly substratum occurring either within the soil profile or below it.

At the point of confluence of the small streams with the rivers alluvial fans are formed which in many instances contain considerable quantities of small shale and sandstone fragments; otherwise the type is free of gravel on the surface and in the upper part of the soil section.

The Moshannon silt loam is found in the western part of Marion and Monongalia Counties, occurring in all the stream valleys. The total extent of the type, however, is small. It forms the first bottoms of the creeks and runs and is subject to annual overflow at times of high water. It is associated

with the Meigs clay loam, the residual upland soil derived from the different rock strata of the Dunkard formation. It represents wash or sediments carried down the slopes by the rains and taken up and deposited lower down the stream courses during flood stages. Next the upland slopes the soil material no doubt largely represents accumulations from the adjacent slopes.

The type is an alluvial soil of recent origin. The Meigs clay loam, which, as previously stated, is derived from the Dunkard formation, is characterized by the presence of bands of Indian-red soil on the slopes, where it joins with other soils formed from the gray shales and sandstones. The wash from these red soils has imparted a reddish tinge to the bottom land soils of that particular section and distinguishes them from the Huntington silt loam, which, on account of its different origin, is of a chocolate-brown color.

The streams along which this type occurs are still cutting their channels and no extensive first bottoms occur. Small first bottoms, however, are always present, varying in width from a rod or two on the smaller streams to not over one-eighth of a mile on the larger ones. These bottom are flat or rise gradually to the upland slopes. On the runs they lie 2 or 3 feet above the stream levels, but along the larger streams their elevation is ordinarily from 5 to 10 feet, and never exceeds 20 feet.

The position occupied by the Moshannon silt loam enables it to maintain a good supply of moisture at all times, though it is not wet or poorly drained, except over small local areas forming troughs. In places open ditches are dug to assist drainage.

Like the Huntington silt loam, the type is a strong, productive soil. It is excellent for grass, giving large yields of timothy and clover hay. Orchard grass, because of the good supply of moisture, also makes a heavy growth. This grass is planted to some extent and furnishes excellent pasturage, the growth continuing throughout the summer season, while the grass on the uplands is suffering for want of sufficient moisture. A large part of the type is used for mowing land.

Small grain crops make a rank growth and good yield, but lodge. Corn is the leading cultivated crop. In fact, the bottom lands are depended upon to produce all the corn needed on most farms. The yield ranges from 35 to 100 bushels to the acre. Stable manure is generally applied to this land. Some farmers also use small quantities of commercial fertilizers with the corn, especially when the bottoms have been worked for some time or lie above the ordinary level of overflow. Where flooded, fresh additions of rich sediments are annually deposited.

The value of the bottom lands composed of the Moshannon silt loam is high and largely determines the value of farms where they occur.

Sugar maple, poplar, sycamore, walnut, and butternut formed the larger part of the original forest growths.

The following table shows the results of mechanical analyses of samples of the soil and subsoil of the Moshannon silt loam:

Mechanical Analyses of Moshannon Silt Loam.

| No.    | Locality.                      | Description.                       | Fine<br>gravel,<br>2 to 1<br>mm. | Coarse<br>sand,<br>1 to 0.5<br>mm. | Medium<br>sand,<br>0.5 to 0.25<br>mm. | Fine<br>sand,<br>0.25 to<br>0.1<br>mm. | Very<br>fine<br>sand,<br>0.1 to<br>0.05<br>mm. | Silt,<br>0.05 to<br>0.005<br>mm. | Clay<br>0.005<br>to 0<br>mm |
|--------|--------------------------------|------------------------------------|----------------------------------|------------------------------------|---------------------------------------|--|--|----------------------------------|-----------------------------|
|        |                                |                                    | <i>P. ct.</i>                    | <i>P. ct.</i>                      | <i>P. ct.</i>                         | <i>P. ct.</i>                          | <i>P. ct.</i>                                  | <i>P. ct.</i>                    | <i>P. ct.</i>               |
| 220823 | 3 miles west of<br>Mannington. | Brown silt loam,<br>0 to 8 inches. | 0.2                              | 0.5                                | 0.8                                   | 11.0                                   | 17.2   | 45.8                             | 24.7                        |
| 220824 | Subsoil of 220823.             | Silt loam, 8 to 36<br>inches.      | .0                               | .0                                 | 1.0                                   | 14.6                                   | 16.4   | 45.2                             | 22.7                        |

### SUMMARY.

The Morgantown area includes the counties of Marion, Taylor, and Monongalia, situated in the north-central part of the State of West Virginia. It has an area of 560,000 acres, or 815 square miles.

The area consists of an elevated region cut by stream valleys eroded to depths ranging from 300 to 600 feet below the general upland level. The topography is hilly and broken. The altitude ranges from 800 to 2,683 feet above sea level.

The Monongahela River and its tributaries drain the area, the waters flowing north and ultimately finding their way into the Ohio River.

The area is populated by descendants of the early settlers of Scotch-Irish stock and the foreign labor working in the mines. The census of 1910 gives the three counties included in this area a population of 83,682.

The climate is suited to general farming. The mean annual temperature is 53° F. and the mean annual precipitation 41 inches, usually well distributed throughout the year.

Agriculture is in the main confined to the production of the general farm crops and stock raising. Corn, wheat, oats, buckwheat, and potatoes are the principal crops and a relatively large acreage is annually mowed for hay.

The development of the oil and gas resources has taken the labor from the farms by offering higher wages. The income from the rentals and royalties generally exceeds that from the farm, and these, together with the sale of the workable beds of coal, have put most owners in good financial condition.

There are many opportunities for successful agriculture in the region. Stock raising could well be extended by improving the pastures through more frequent reseeding and by using commercial fertilizers. In this way the grazing capacity could be greatly increased. The rougher lands, especially in the western part of the area where sheep do so well, should be devoted to grazing.

Fruit growing, particularly apples, would prove profitable under good management. There are good orchard sites on most farms.

The demands of the local markets warrant the development of the trucking industry. The high terrace soils are well suited to a wide range of trucking crops. There is also opportunity for increased production of dairy products, the demand for them showing a steady growth.

There is much land that should be used for forestry, particularly the steeper slopes, where timber for fence posts could be grown profitably.

Ten soil types, exclusive of Rough stony land, were separated and mapped in the area. These are divided into two classes, according to origin: (1) residual soils, and (2) alluvial soils. The former occupy the uplands and are derived from a variety of shales, sandstones, and limestones of Carboniferous age; the latter have been deposited as stream sediments in the valleys.

The Meigs clay loam is one of the extensive upland soils found in the western and central parts of the area. It is derived from the Dunkard formation of the Upper Carboniferous. It has a steep, broken topography and is used largely for pasturage. It is a good grass soil.

The Westmoreland silty clay loam is the "limestone land" of the region. It is especially valued for its bluegrass pastures and is used almost entirely for grazing cattle.

The Dekalb silty clay loam is an extensive soil type found in the eastern and central parts of the area. It is not a strong grass soil, though used for grazing. It is devoted to the general farm crops.

The Dekalb silt loam occupies the flat tops of hills overlying beds of massive sandstone. It is an easily cultivated soil, but is not strong. Potatoes and buckwheat succeed well upon it.

The Dekalb stony loam is found mostly on the mountain ridges in eastern Monongalia County, occurring on the long, smooth slopes. It produces fine crops of corn, buckwheat, and potatoes.

Rough stony land comprises the cliffs of massive sandstone found on the hillsides, together with talus slopes below. It has no value except for forestry and a little grazing.

The valley or alluvial soils occupy the terraces and bottoms along the streams. The most important type is the Elk silt loam, found along the Monongahela and its tributaries. This type is derived in part from wash from limestone soil. Though it is not a strong grass soil, it is easily improved and has a wide crop adaptation. This soil is fairly well located for the production of truck crops to supply the local markets and the mines.

The Holston silt loam occupies the same topographic position as the Elk silt loam, but is not as strong a soil, not being influenced to so great an extent by calcareous soil material.

The Tyler silt loam is of small extent, found usually on second terraces, and is poorly drained. It is a good grass soil.

The first bottoms comprise two types, the Moshannon silt loam and the Huntington silt loam. The former is found in the western part of the area and is of reddish color, being influenced by wash from the red shale soil levels occurring in the Meigs clay loam. The latter is the brownish colored soil found elsewhere in the area, and is also influenced to some extent by wash from the limestone land areas. Both these soils are strong and productive and are important factors in the agriculture. Though the areas occupied by them are small, they are widely distributed and occur on practically every farm.

# APPENDIX.

## LEVELS ABOVE MEAN TIDE.

### Main Line of the Baltimore and Ohio Railroad.

| Distance<br>from Grafton<br>Miles | Station                    | County        | Elevation<br>Above Tide<br>Feet |
|-----------------------------------|----------------------------|---------------|---------------------------------|
| 11.7                              | Independence .....         | Preston ..... | 1165.86                         |
| 10.2                              | Hardman .....              | Preston ..... | 1116.02                         |
| 8.8                               | Irontown .....             | Taylor .....  | 1078.77                         |
| 5.7                               | Thornton .....             | Taylor .....  | 1042.99                         |
| 2.9                               | Lesmalinston .....         | Taylor .....  | 1029.28                         |
| 0.0                               | GRAFTON (old station)..... | Taylor .....  | 999.85                          |
| 1.1                               | Fetterman .....            | Taylor .....  | 990.14                          |
| 5.9                               | Coffman .....              | Taylor .....  | 984.20                          |
| 7.7                               | Valley Falls.....          | Marion .....  | 974.16                          |
| 9.7                               | Hammond .....              | Marion .....  | 941.49                          |
| 10.6                              | Powell .....               | Marion .....  | 906.61                          |
| 14.2                              | Colfax .....               | Marion .....  | 890.70                          |
| 17.3                              | Benton Ferry.....          | Marion .....  | 889.03                          |
| 20.6                              | Gaston Junction.....       | Marion .....  | 885.46                          |
| 21.8                              | FAIRMONT .....             | Marion .....  | 882.66                          |
| 23.3                              | WD Tower .....             | Marion .....  | 876.70                          |
| 24.2                              | Barnestown .....           | Marion .....  | 876.55                          |
| 27.2                              | Barrackville .....         | Marion .....  | 905.89                          |
| 32.6                              | Underwood .....            | Marion .....  | 935.53                          |
| 36.4                              | Downs .....                | Marion .....  | 962.98                          |
| 39.7                              | Mannington .....           | Marion .....  | 973.61                          |
| 43.9                              | Metz .....                 | Marion .....  | 1001.96                         |
| 46.8                              | Glover Gap.....            | Marion .....  | 1040.39                         |
| 51.0                              | Burton .....               | Wetzel .....  | 1065.55                         |
| 53.5                              | Hundred .....              | Wetzel .....  | 1017.50                         |

### Grafton and Parkersburg Branch of the B. & O. Railroad.

| Distance<br>from Grafton<br>Miles | Station                    | County         | Elevation<br>Above Tide<br>Feet |
|-----------------------------------|----------------------------|----------------|---------------------------------|
| 0.0                               | GRAFTON (old station)..... | Taylor .....   | 999.85                          |
| 1.4                               | Woodford .....             | Taylor .....   | 999.8                           |
| 3.4                               | Webster .....              | Taylor .....   | 1018.0                          |
| 5.7                               | Bryden .....               | Taylor .....   | 1110.0                          |
| 7.6                               | Simpson .....              | Taylor .....   | 1099.0                          |
| 9.7                               | Flemington .....           | Taylor .....   | 1027.0                          |
| 11.6                              | Rosemont .....             | Taylor .....   | 1003.0                          |
| 17.2                              | Bridgeport .....           | Harrison ..... | 984.0                           |
| 22.2                              | CLARKSBURG .....           | Harrison ..... | 1008.7                          |



## Grafton and Belington Branch of the B. &amp; O. Railroad.

| Distance from Grafton Miles | Station          | County        | Elevation Above Tide Feet |
|-----------------------------|------------------|---------------|---------------------------|
| 0.0                         | GRAFTON .....    | Taylor .....  | 999.85                    |
| 5.4                         | Stonehouse ..... | Taylor .....  | 1001.5                    |
| 6.9                         | Cecil .....      | Taylor .....  | 1011.0                    |
| 8.8                         | Sandy .....      | Barbour ..... | 1035.6                    |
| 41.3                        | Belington .....  | Barbour ..... | 1701.6                    |

## Monongahela River Branch of the B. &amp; O. Railroad.

| Distance from Fairmont Miles | Station              | County         | Elevation Above Tide Feet |
|------------------------------|----------------------|----------------|---------------------------|
| 0.0                          | FAIRMONT .....       | Marion .....   | 882.66                    |
| 1.2                          | Gaston Junction..... | Marion .....   | 885.46                    |
| 2.0                          | Watson .....         | Marion .....   | 884.91                    |
| 2.0                          | Gaston Mine.....     | Marion .....   | 882.84                    |
| 3.5                          | Norway .....         | Marion .....   | 889.87                    |
| 5.9                          | Monongah .....       | Marion .....   | 890.63                    |
| 7.4                          | Pennois .....        | Marion .....   | 894.0                     |
| 7.9                          | Everson .....        | Marion .....   | 890.66                    |
| 8.7                          | Highland .....       | Marion .....   | 891.14                    |
| 10.0                         | Chiefton .....       | Marion .....   | 894.96                    |
| 11.1                         | Worthington .....    | Marion .....   | 895.51                    |
| 11.9                         | Hutchinson .....     | Marion .....   | 903.22                    |
| 13.3                         | Enterprise .....     | Harrison ..... | 909.91                    |
| 32.1                         | CLARKSBURG .....     | Harrison ..... | 1008.72                   |

## Fairmont, Morgantown and Pittsburgh Branch of the B. &amp; O. Railroad.

| Distance from Fairmont Miles | Station                  | County           | Elevation Above Tide Feet |
|------------------------------|--------------------------|------------------|---------------------------|
| 0.0                          | FAIRMONT .....           | Marion .....     | 882.66                    |
| 1.7                          | F. M. & P. Junction..... | Marion .....     | 876.92                    |
| 2.4                          | Hoult .....              | Marion .....     | 881.90                    |
| 4.1                          | Rivesville .....         | Marion .....     | 880.0                     |
| 4.9                          | Montana .....            | Marion .....     | 877.50                    |
| 6.8                          | Catawba .....            | Marion .....     | 873.90                    |
| 8.9                          | Murray .....             | Marion .....     | 870.50                    |
| 10.7                         | Opekiska .....           | Monongalia ..... | 877.70                    |
| 13.1                         | Beechwood .....          | Monongalia ..... | 862.00                    |
| 16.5                         | Little Falls.....        | Monongalia ..... | 849.90                    |
| 19.0                         | Round Bottom.....        | Monongalia ..... | 842.60                    |
| 21.7                         | Uffington .....          | Monongalia ..... | 829.20                    |
| 24.8                         | Russell Siding.....      | Monongalia ..... | 820.00                    |
| 26.1                         | MORGANTOWN .....         | Monongalia ..... | 822.06                    |
| 27.1                         | Seneca .....             | Monongalia ..... | 829.50                    |
| 28.9                         | Star City.....           | Monongalia ..... | 824.05                    |
| ....                         | Van Voorhis .....        | Monongalia ..... | 818.05                    |
| ....                         | Hoard .....              | Monongalia ..... | 816.05                    |
| 38.1                         | Point Marion.....        | Fayette, Pa. . . | 819.05                    |

**Morgantown & Kingwood Railroad.**

| Distance from<br>Morgantown<br>Miles | Station                           | County        | Elevation<br>Above Tide<br>Feet |
|--------------------------------------|-----------------------------------|---------------|---------------------------------|
| 0.0                                  | MORGANTOWN .....                  | Monongalia .. | 824.0                           |
| 0.7                                  | Siding .....                      | Monongalia .. | 831.0                           |
| 0.9                                  | Siding .....                      | Monongalia .. | 825.2                           |
| 1.0                                  | Valley Crossing.....              | Monongalia .. | 823.8                           |
| 1.3                                  | Siding (Marilla).....             | Monongalia .. | 833.1                           |
| 1.5                                  | Siding, Mine No. 5.....           | Monongalia .. | 835.0                           |
| 1.8                                  | Siding (Shops).....               | Monongalia .. | 837.5                           |
| 1.9                                  | Pool Rocks.....                   | Monongalia .. | 838.1                           |
| 2.4                                  | Siding (Glass Plant).....         | Monongalia .. | 849.5                           |
| 2.5                                  | Sabraton .....                    | Monongalia .. | 852.7                           |
| 2.5                                  | Siding (Glass & Steel Plate)..... | Monongalia .. | 853.4                           |
| 3.8                                  | Rock Forge & Siding.....          | Monongalia .. | 967.5                           |
| 4.6                                  | Richard .....                     | Monongalia .. | 1044.0                          |
| 5.9                                  | Dellslow .....                    | Monongalia .. | 1174.4                          |
| 8.8                                  | Switch, Lime & Sand Plant.....    | Monongalia .. | 1406.2                          |
| 9.0                                  | Sturgisson .....                  | Monongalia .. | 1410.0                          |
| 9.1                                  | Siding (Lumber Dock).....         | Monongalia .. | 1411.4                          |
| 9.9                                  | Iron Bridge.....                  | Monongalia .. | 1450.0                          |
| 10.0                                 | Siding (Lick Run).....            | Monongalia .. | 1464.5                          |
| 10.5                                 | Lick Run.....                     | Monongalia .. | 1481.5                          |
| 12.5                                 | Cascade (and Siding).....         | Preston ..... | 1682.0                          |
| 13.5                                 | Masontown (and Siding).....       | Preston ..... | 1683.0                          |
| 29.6                                 | KINGWOOD .....                    | Preston ..... | 1666.0                          |

For other elevations, determined by the United States Geological Survey, and arranged by quadrangles, the reader is referred to Bulletin II of the West Virginia Geological Survey.

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